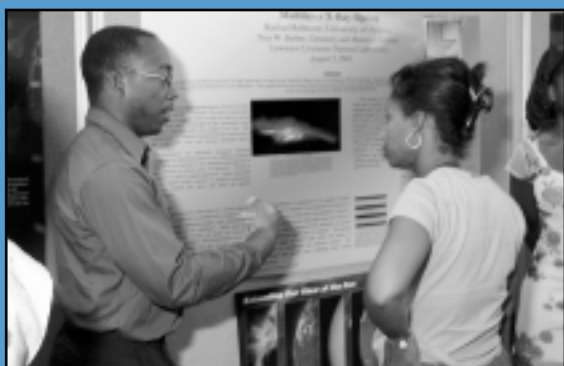


STEP

Science & Technology Education Program

Annual Report FY01



S Science &
T Technology
E Education
P Program

Science Education in the National Interest

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STEP

Science & Technology Education Program

**Annual
Report
FY01**

January 2002

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Overview

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Introduction

From its earliest years, Lawrence Livermore National Laboratory has worked to improve and increase science education opportunities at both the college and pre-college levels. In support of the Laboratory's science education goals, the Science and Technology Education Program (STEP) serves as a resource to students, teachers, and faculty by facilitating research interactions with the Lab's world-class scientific facilities and staff. STEP also coordinates activities and programs to support the science educational needs of the communities surrounding the Laboratory.

The common theme of our science education activities is the integration of education, research, and career options at all school levels—pre-college, undergraduate college, and graduate university. By providing opportunities for students, teachers, and faculty to actively participate in Laboratory research, STEP helps to create a seamless path from student to professional workforce, as illustrated in figure 1.

STEP's FY01 annual report is organized in four major sections with seven appendices that expand upon our two major activity areas:

- Research internships for college students entering careers important to the intellectual capability required by the Laboratory's national security mission
- Science education projects with K-12 students and partnerships with various K-14 educators within the Laboratory's local and state communities

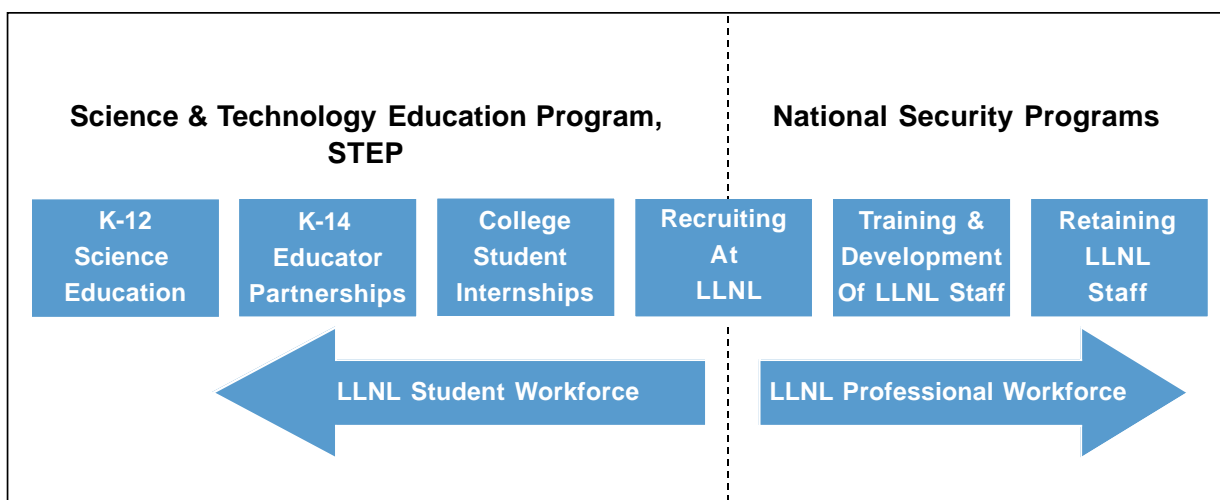


Fig 1. STEP facilitates student research in disciplines important to the intellectual capability of the LLNL national security mission

College Student Research Internships – Section 1

STEP facilitates partnerships and collaborations with the education community to help ensure a highly skilled, diverse workforce for the science and technology challenges facing the national security mission of the National Nuclear Security Administration (NNSA).

STEP's internship projects target college students (undergraduate and graduate) in four major disciplines: chemistry and materials science, computer science, engineering, and physics.

The vast majority of STEP's stockpile-stewardship internships are funded directly by the NNSA/Defense Programs Office of University Partnerships (DP-OUP). Individual internship projects support the specific "critical skills" recruiting needs of Laboratory programs sponsored by NNSA.

STEP also partners with various program elements of the LLNL Stockpile Stewardship Program to develop specific college-student recruitment programs. One example is the High-Energy-Density Physics Program, which has the goal of fulfilling recruitment needs of a particular program element within the Stockpile Stewardship Program.

STEP has had an ongoing partnership with the LLNL National Security Office to provide internship opportunities for U.S. military academy cadets/midshipmen and college Reserve Officer Training Corps (ROTC) students in support of the common mission goals between the Department of Defense (DoD) and Department of Energy (DOE).

During FY01, 117 college/university/military academy students participated in college internships that required "residency" within the LLNL Stockpile Stewardship Program. In some cases, faculty, from the same colleges as the interns, spent time at LLNL involved in similar research as their students. For example, two faculty members from the West Point Army academy also spent a faculty summer sabbatical at LLNL.

Of 117 students, 71 interns were funded by DP-OUP, 21 were funded by the LLNL Defense & Nuclear Technologies (D&NT) directorate, and 25 were funded by the Lab's National Security Office (NSO), as detailed in table below.

FY 2001 STEP College/University/Military Academy Internship Projects

Partners and STEP internships in national security projects	Number of interns
NNSA DP-OUP	
Accelerated Strategic Computing Initiative (ASCI) Pipeline	12
Actinide Sciences Summer School	6
Interns for Defense Technologies	20
Internships in Terascale Simulation Technology	27
System Administration Computer Support	6
LLNL Defense and Nuclear Technologies Directorate	
High-Energy-Density Physics Program	21
LLNL National Security Office	
Military Academic Research Associates (MARA)	21
Reserve Officer Training Corps (ROTC)	4
Total	117

Through these internship projects, as mentioned above, STEP aims to support the vision captured in a report to Congress titled “Nuclear Skills Retention Measures within the Department of Defense and the Department of Energy” (Part II, Chapter 5, page 41, November 3, 2000):

“By giving U.S. students the opportunity to experience the challenges and stimulation that is integral to research, many are motivated to pursue the advanced degrees required for most of the scientific and technical positions at DP laboratories.”

Military Academy Research Associates/ROTC – Section 2

To ensure our nation’s security, the United States requires a scientifically and technically literate work force for both civilian and military personnel. In the case of the military, it is important that officers are also knowledgeable about the science and technology capabilities of the major DoD and DOE laboratories and how that science and technology can be utilized to improve the capabilities of the military services.

In collaboration with the LLNL National Security Office, STEP manages a program called Military Academic Research Associates (MARA). MARA is also a partnership with all three DOE NNSA national laboratories (LLNL, Los Alamos National Laboratory, and Sandia National Laboratories), leveraging the rich scientific and technical base of the laboratories. In an effort to expand the DOE/DoD connection, STEP has included internship opportunities for ROTC cadets and midshipmen from within the state of California and nationally.

MARA/ROTC internships were provided throughout the year for undergraduate and graduate cadets/midshipmen to work in areas such as the National Ignition Facility, advanced manufacturing, high-performance computing (ASCI), non-proliferation and arms control, intelligence assessment, and other projects representing programs that focus on national security issues.

In FY01, under STEP’s management, the MARA/ROTC program expanded to include two additional national laboratories: Idaho National Engineering and Environmental Laboratory (INEEL) and Oak Ridge National Laboratory (ORNL), in addition to the three NNSA national laboratories. A central STEP Web site serves as a focal point for MARA/ROTC information and application review.

K-12 Student Projects and K-14 Educator Partnerships – Section 3

STEP leads the Laboratory’s science education activities through K-12 student projects and K-14 educator partnerships. Our science education and educator partnerships are supported with funding from the LLNL general and administrative distributed budget.

Our K-12 science education activities play an important role in the creation of future scientists, engineers, and technicians by enlightening students about potential careers in science and technology, especially those of special interest to Livermore Laboratory.

Our K-14 educator partnerships provide teachers with a means to understand and gain access to scientific and technical research efforts at LLNL, thus, improving the quality of science teaching and learning in California. These educator partnerships are aligned with new science standards of the State of California.

During FY01, STEP science and technology education projects engaged approximately 9,300 students and 1,200 teachers (about 10% from community colleges) as detailed in the tables below.

K-12 Student Projects	Number of participants
COSMOS (University of California program)	12
Expanding Your Horizons (three conferences)	1,400
Explorer Post	50
Fun With Science	5,700
Future Scientists and Engineers of America	75
Groundwater Assessment Course	60
Math Challenge	50
Science on Saturday	1,700
Student Research Academy	12
Tri-Valley Science and Engineering Fair	250
Approximate Total	~9,300

K-14 Partnerships (For Teachers)	Number of participants
Computer Technology Workshops	300
Crystals in the Classroom	2
Educational Partnerships	400
Edward Teller Science and Technology Symposium	120
Great Explorations in Math and Science (GEMS)	150
Laser Science and Optics in the Classroom	30
Promoting Achievement through Hands on Science	60
UC/Community College/Central Valley Education	120
Approximate Total	~1,200

Our science education K-12 projects and K-14 partnerships continue to make an important long-term contribution to our nation's security by:

- Motivating students
- Supporting a scientifically literate population, and
- Educating future scientists, engineers, and technicians

Edward Teller Education Center (ETEC) – Section 3

LLNL STEP has partnered with the University of California, Davis, and the University of California, Merced, to create the Edward Teller Education Center at the UC Davis Department of Applied Sciences (DAS), adjacent to LLNL. ETEC has also received operational funding from the University of California Office of the President to provide district-driven, ongoing professional development for California teachers of grades K-12, from career entry to mastery level.

ETEC will use existing and new facilities of the DAS campus—with existing and new capabilities within STEP's K-14 projects—to provide professional development instruction for K-12 science teachers in addition to specialized science classes for high school students. The collaboration will provide a vehicle to leverage each member's respective science education program intended to make a significant contribution to the quality of California science teaching and learning.

By using existing facilities and existing capabilities, ETEC played a principle role in two K-12 student projects (COSMOS and Student Research Academy) and four K-14 educator projects (Computer Technology Workshops, Educational Partnerships, Edward Teller Science and Technology Symposium, and UC/Community College/Central Valley Education) listed in the tables above.

Within the next year, ETEC will become a fully operational K-12 professional-development facility with a capacity to serve up to 1,000 teachers from the Livermore Tri-Valley area to the Central Valley region, including Stockton, Merced, and Modesto. The construction project for a modular high-school science room, with both wet lab and computer lab capabilities, is scheduled to be completed in April 2002.

Institutional Education Activities – Section 4

STEP continues to take the lead in facilitating and piloting numerous LLNL educational initiatives. STEP leads the Lab's Institutional Education Committee (IEC) to combine efforts throughout the Lab to promote student activities. This includes updates to the student and faculty Web-based directory, available at <http://www.llnl.gov/education>. FY01 is the second year STEP has acquired a site-wide license for the GRE PowerPrep and helped students prepare for the Graduate Record Exams. In conjunction with the IEC, seminars, tours with socials, and a series of panel discussions are offered to all summer participants. Students are also offered a method by which they may network with other students, an electronic Student Bulletin Board (SBB), available at <http://step.llnl.gov/sbb/>.

Directions for FY02

For our DP Office of University Partnerships projects in FY02, STEP is planning to have a full complement of internships targeted at undergraduate and graduate college students in the four core competencies:

- Chemistry and Materials Science
- Computer Science
- Engineering
- Physics

These core competencies align with the stockpile stewardship critical-skills list recently created by LLNL and LANL, as discussed between the University of California and the NNSA. STEP can then easily define to college students these core competencies, as they relate to the critical-skills list, and then present applicable internship opportunities. STEP is looking forward to supporting its DP Office of University Partnerships internship projects in FY02 to further support the goals of NNSA Defense Programs. In this role, STEP continues serving as a major contributor to the critical-skills recruitment efforts within the LLNL Stockpile Stewardship Program.

During FY02, STEP's local and regional science-outreach and K-14 educator-partnership projects will be expanded to the entire state of California, supported by its partnership with the University of California's K-12 program. The UC K-12 program has a collaborative relationship with public schools, post-secondary institutions, and education agencies. Each of the 10 UC campuses has a unique set of K-12 activities available as part of a system-wide initiative to help more students become eligible for college.



Fig. 2. Instructor (far right) is now-retired Computer Science employee Edna Carpenter.

STEP will continue to work closely with the UC Davis and UC Merced campuses through a collaborative partnership, which supports the Edward Teller Education Center. ETEC will assess the K-12 districts to determine science and technology faculty needs. The Center will then provide developmental opportunities to meet the needs of the teachers. The science and technology will focus on the “world-class” scientific resources and researchers available at LLNL. It will also make use of professional-development outreach programs that are currently offered through STEP.

It should be noted that Lawrence Livermore National Laboratory marks its 50th anniversary during the year 2002. Since its inception, LLNL has supported the science education community by providing access to its

unique facilities and staff expertise. Figure 2 illustrates this support by showing how, in 1959, two California science teachers received professional development in computers from a Laboratory computer science employee.

The continuing education commitment at LLNL finds its roots in the close relationship between the Laboratory and the University of California system, and through the realization that the Lab’s leading edge research requires the development of specific critical skills not readily available from universities.

STEP science education and college internship activities will continue to grow in FY02 from existing and new collaborations with California schools, University of California, and other U.S. colleges and universities, and the two other NNSA national laboratories—Los Alamos National Laboratory and Sandia National Laboratories.

Section 1 – College Student Research Internships

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Introduction

During FY01, STEP placed 92 college/university students within the following LLNL Stockpile Stewardship Program internship projects:

FY01 Stockpile Stewardship Internship Projects	No. of Interns
Accelerated Strategic Computing Initiative (ASCI) Pipeline	12
Actinide Sciences Summer School	6
Interns for Defense Technologies	20
Internships in Terascale Simulation Technology	27
System Administration Computer Support	6
<i>Sub-Total for DP Office of University Partnerships Funding</i>	<i>71</i>
High-Energy-Density Physics Program	21
Total for LLNL Stockpile Stewardship	92

In the last two fiscal years (FY01 and FY00), 18 students have been hired at LLNL from the DP Office of University Partnerships a total of 126 interns. This does not include the MARA/ROTC students, as discussed in Section 2.

The overall hiring rate of approximately 15% is an average across all projects funded by the DP Office of University Partnerships. The community college intern project has hiring rates as high as 30% or more. As expected, it will take more years of data to properly reflect the “return on investment” for intern projects involving graduate students who typically spend five years or more working toward a doctoral degree. Forty of the 92 FY01 interns have been placed in “indeterminate” employment status, which allows them to return to their respective technical programs next summer and during academic school-year breaks.

In addition to the five projects funded by the DP Office of University Partnerships, there has been an additional college internship project, High-Energy-Density Physics Program. STEP has played a major role in the initial definition and implementation of recruitment efforts for internships candidates to work with various elements of the LLNL Stockpile Stewardship Program within the Defense & Nuclear Technologies directorate.

Accomplishments of all six of the internship projects are discussed individually in this section in alphabetical order:

- Accelerated Strategic Computing Initiative Pipeline (ASCI)
- Actinide Sciences Summer School Program (ASSSP)
- High-Energy-Density Physics Program (HED)
- Interns for Defense Technologies (IDT)

- Internships in Terascale Simulation Technology (ITST)
- System Administration Computer Support (SACS)

Collectively, these six projects address critical skills recruiting needs throughout the LLNL Stockpile Stewardship Program. Historically, the DOE Defense Program laboratories have been able to draw upon their individual, internal population to meet the Stockpile Stewardship Program (SSP) work force needs. However, present estimates indicate a growth—as high as a 25%—in the need for SSP employee numbers over the next five years, given certain budgetary assumptions.

As part of the ongoing Appendix O/University of California contract deliverable discussions, LLNL and LANL have jointly created a stockpile stewardship critical skills, knowledge, and technical capabilities list to quantify the needs within 13 major Stockpile Stewardship Program categories, as listed below. Specifically, the STEP critical-skills internship projects in FY01 have the potential to impact all 13 major critical-skills categories.

Critical-Skill Categories	STEP Intern Projects*
Nuclear Design and Evaluation	HED, IDT, ITST
Physics	HED
High-Performance Computing and Simulation	ASCI, HED, ITST, SACS
Materials Science and Technology	ASSSP
Engineering Design and Evaluation for Weapons	IDT
Manufacturing	IDT
Dynamic Experimentation and Diagnostics	HED, IDT
Lasers, Pulsed Power, Accelerators	HED
ICF/HED Weapons Experiments and Analysis	HED
Underground Experimentation	HED, IDT
Hazard-Ranked Facility Operations and Security	IDT
Arms Control and Non-Proliferation	HED
Emergency Response	IDT

*STEP Intern Projects

ASCI: Accelerated Strategic Computing Initiative Pipeline

ASSSP: Actinide Sciences Summer School Program

HED: High-Energy-Density Physics Program

IDT: Interns for Defense Technologies

ITST: Internships in Terascale Simulation Technology

SACS: System Administration Computer Support

STEP student internships at LLNL will be part of the overall recruitment strategy, to help create an additional external pipeline of college and university students who have had direct contact with NNSA science through their onsite research experiences.

Project Title: Accelerated Strategic Computing Initiative (ASCI) Pipeline

URL: http://step.llnl.gov/asci_interns/

Project Purpose

The purpose of this project is to increase the:

- Number of ethnically-diverse U.S. students majoring in computer science
- Awareness of Accelerated Strategic Computing Initiative (ASCI) opportunities at NNSA Defense Programs laboratories
- Number of students pursuing careers in the new scientific discipline of high-performance, computer-based modeling and simulation

Project Description

Summer students are recruited in the fall and early winter, based on recommendations from computer-science faculty and through general recruiting efforts. Applicants complete an electronic interest form available from http://step.llnl.gov/asci_interns/. Once the applications are received, they are distributed to key ASCI employees, who review applicants for summer employment and match them to specific projects. ASCI researchers are encouraged to contact applicants to discuss and assess student interests and skills, and identify possible project matches. Once the student and researcher have agreed on a project of mutual interest, the candidate completes an LLNL job application, submits the security clearance paperwork, and receives a formal job offer.

During the interim period, researchers are encouraged to maintain contact with the students, refer them to Web sites and mail them additional information on the project, so that the students become a part of the research teams even before they arrive onsite.

Upon their arrival, students will work at the Lab for approximately 12 weeks on a variety of different projects within the ASCI Program and Computation Directorate, which will ensure the students have access and exposure to high-level computational science. In addition to the research experience, students are required to participate in the ASCI Pipeline Lecture Series (see http://step.llnl.gov/asci_interns/schedule.html), give an oral presentation to peers within their working group, and summarize their experience in the form of an electronic portfolio. The portfolio briefly describes the student's academic major, the LLNL research project, perceived benefits by the participant, and any additional Web resources for more information. (Student portfolios are available at <http://step.llnl.gov/portfolio/>.) The electronic portfolio can be used as a reference on a resume. In addition, it serves as a recruitment tool. Future students may access and review these portfolios to obtain additional information about the LLNL NNSA DP projects, to which they may apply.

NNSA DP/LLNL Mission Benefits

High-performance computing, specifically the Accelerated Strategic Computing Initiative (ASCI), is one of two major NNSA programs at LLNL. This, coupled with Laboratory's location within the Bay Area and Silicon Valley, compounds recruiting challenges to address work force needs. The work force shortage addressed by this project is evidenced by the fact that, in FY00, within the

computer science classification in Defense Program relevant programs, there were only 18 full-time employee (FTE) hires compared to 31 employee terminations. The increasing number of non-U.S. citizens attending graduate schools further compounds this projected work force shortage.

Partners

Laboratory

- Accelerated Strategic Computing Initiative
- Defense & Nuclear Technologies Directorate
- Computation Directorate

Non-Laboratory

- California State University, Hayward (CSUH)
- Northern Arizona University (NAU)
- University of Utah/CSAFE
- San Jose State University
- University of the Pacific
- U. S. universities

Objectives

- Increase recruitment of ASCI Pipeline participants to 20 student interns (upper-division undergraduate) who are U.S. citizens and expand on a national scale.
- Fulfill a need for more U.S. citizens who are computer science graduates with backgrounds in the scientific parallel-processing environment, to work at LLNL or other DP-managed Laboratories.
- Increase awareness of graduate opportunities at the first-level ASCI Alliance schools.

FY01 Accomplishments

- Hired six ASCI Pipeline participants—three in FY00 and three in FY01. Four came from NAU and two came from CSUH. At a time, when there were 18 hires and 31 terminations of computer scientists in FY00 in DP-relevant programs, hiring three candidates (17%) from a single program was a significant accomplishment.
- Two of the six hires discussed above were from under-represented ethnic minorities.
- Implemented an ASCI Pipeline technical lecture series (http://step.llnl.gov/asci_interns/schedule.html). (See Appendix 2.)
- Recruited 11 participants in summer 2001, 10 of whom have been retained as indeterminate employees. Another participant plans to attend summer school in FY02.
- The 10 students who have retained “indeterminate” status are supporting their projects while at school.

FY01 Accomplishments *continued*

- Designed an ASCI Pipeline poster to advertise the program.
- Participated in the spring and fall Northern Arizona University (NAU) College of Engineering & Technology (CET) Employment and Internship Fair. Assisted with the individual interviewing on the second day.

Evaluation/Assessment

Feedback from FY01 participants indicated that good matches were made between the students and their projects. Students were able to use and expand upon their programming skills. When the students were asked what they gained from the experience, two responded, “I believe that I learned much more about how to work with individuals of different interests—this experience will help me greatly in the future.” and “I received an ample supply of practical experience in computing and building computer programs in a team environment.”

A number of students acquired computer knowledge and skills, ranging from Python and advanced UNIX to SGI machine utilization and advanced fluency in C++. Other students learned about programming sockets and building libraries in the Windows environment, while others learned about parallel computing skills and knowledge, and integrating applications and the operating system.

When asked what makes an LLNL experience unique, the typical response included student access to large-scale parallel computer systems and the many experts in different computer science areas.

Students were asked if the LLNL summer internship influenced their decision about a career direction. Students generally responded by saying that it helped them gain confidence in applying the theory learned in the classroom to real-life projects or that it increased their awareness of the opportunities available.

Many students entering one internship project found that their interests changed during the course of their education and they became more aligned with another core discipline and/or specific stockpile-stewardship-program (SSP) critical skill. When students were exposed to all of the STEP NNSA-DP-Education internships, the students developed a broader understanding of the needs within all SSP-relevant areas at LLNL.

- Interns are required to document their summer research by participating in the STEP summer-student research-poster symposium



ASCI Pipeline recruitment poster



(<http://step.llnl.gov/symposium>) and/or by making oral presentations to their respective DP-“line” programs.

- STEP interns and all LLNL summer students are provided workshops and lectures that describe the LLNL mission-based science research and how to participate more effectively. Details can be seen at the STEP-sponsored “student bulletin board” at <http://step.llnl.gov/sbb>.

Project Title: Actinide Sciences Summer School Project (ASSSP)

URL: <http://step.llnl.gov/asp/>

Project Purpose

The purpose of the Actinide Sciences Summer School Project (ASSSP) is to address the long-term manpower and core-competency needs of the National Nuclear Security Administration (NNSA) defense-related programs within DOE. This project supports programs requiring expertise in the fields of actinide chemistry, physics, and materials science.

To accomplish this we continue to partner with the Glenn T. Seaborg Institute for Transactinium Sciences (GTS-ITS) at LLNL, whose purpose is to provide education and research training in transactinium science for undergraduate and graduate students. ASSSP is aimed at undergraduate students who have shown an interest in the field of nuclear science, e.g., at the Nuclear Summer Schools at San Jose State University and Brookhaven National Laboratory. These summer school projects are funded by the DOE/Basic Energy Science and are sponsored by the American Chemical Society (ACS).

The LLNL ASSSP project is laboratory-based and builds on the students' classroom education, in conjunction with the San Jose State and Brookhaven Nuclear Summer Schools.

ASSSP is an accredited class, through the University of California, Berkeley, that offers students hands-on laboratory work with actinides and provides them training in the use of state-of-the-art instrumentation. In this regard, ASSSP at LLNL is unique and complements American Chemical Society summer schools, as well as an established classroom-based school at the University of New Mexico (sponsored by Los Alamos National Laboratory).

It is essential to encourage students' interest in this field until the students actually graduate from college. In addition, students need to be offered support as they pursue graduate studies or careers in actinide sciences. The importance of ASSSP is intensified by the shortage of actinide experts at the DOE facilities and, in fact, the world. This sector of the scientific community continues to retire, leaving ever-widening gaps in the core capabilities of the programs and disciplines throughout the DOE complex.

Project Description

Students are recruited from the Nuclear Summer Schools at San Jose State University and Brookhaven National Laboratory. Additionally, the Science and Technology Education Program maintains a Web site with an online application. Student applications are accepted through February, at which time a committee selects the candidates based on the student's academic credentials, statement of interests, related experiences, match to projects, and available researchers for the coming summer.

ASSSP students are partnered with LLNL scientists on research projects where they are offered valuable laboratory experience with plutonium and other actinides. They also receive training in the use of state-of-the-art nuclear instrumentation. Scientific staff members from research



Actinide Sciences Summer School recruitment poster

programs at LLNL act as individual mentors to the students and serve as counselors for educational possibilities that may exist.

During the eight-week project (mid-June to mid-August), distinguished actinide scientists from across the United States are invited to give presentations to the students. At the end of ASSSP program, the students are required to present their results in the form of poster presentations to the Laboratory staff. A committee—consisting of the University of California, Berkeley professors and LLNL staff—works together to determine grades, based on student research projects and presentations.

NNSA DP/LLNL Mission Benefits

Nuclear science, including isotopic analysis, chemical separations, and simulation/detection of radiation, all of which is central to stockpile stewardship and nuclear threat reduction. The same skills that are important for the national security missions are also critical for nuclear science applications in energy, environment, and health. Critical skills planning at LLNL has revealed that the Chemistry and Materials Science Directorate anticipates

hiring five to 10 Ph.D.-level nuclear scientists each year for the next several years. This is about 5-10% of the total number of scientists graduating from all United States programs (nuclear scientists being defined as nuclear physicists, chemists, and engineers). The combined needs of NNSA laboratories amount to a significant fraction of graduating nuclear science Ph.D. students who are U.S. citizens, making these laboratories important customers for the nuclear science education system. A primary focus of this program is to provide incentives to students to pursue careers in national security-related areas. This will be accomplished by introducing participants to the exciting and important challenges that exist at this and other NNSA laboratories.

Partners

Laboratory

- The Glenn T. Seaborg Institute for Transactinium Sciences (GTS-ITS)
- LLNL Chemistry & Materials Science, Engineering, and Energy Directorates

Non-Laboratory

- The American Chemical Society
- Brookhaven and San Jose State University (ACS Radiochemistry Summer School)
- Los Alamos National Lab and the University of New Mexico
- U. S. student participants
- U. S. universities, i.e., University of California, Berkeley; University of Tennessee; Massachusetts Institute of Technology; Washington State University

Objectives

- Expose students to the actinide sciences so that they may consider careers in fields which are at the heart of the DOE critical-skills mission: stockpile stewardship, nuclear energy, environmental remediation, and radiochemical diagnostics.
- Assist the Laboratory and DOE by educating and training the future generation of scientists in the knowledge and expertise required to meet the nation's changing needs in environmental protection and remediation, nuclear waste isolation, national security, nuclear surveillance, nuclear energy, and industrial applications of nuclear methods.

FY01 Accomplishments

- In the last four years, the LLNL ASSSP has resulted in one staff and two postdoctoral hires at LLNL and six students who are now pursuing graduate education in chemistry.
- One ASSSP student won a National Science Foundation fellowship to attend graduate school at UC Berkeley.
- Another ASSSP student was awarded the 2000 Coryell Award (American Chemical Society) for her work in nuclear chemistry at LLNL.
- Identified and provided students with the following appropriate safety courses:
 - Radiological Worker Training
 - Contamination Control
 - C&MS Core ISM (Integrated Safety Management) Orientation and Training
 - Beryllium Awareness
 - Fields and Waves
- Technical lecture series enabled the ASSSP student to meet pioneers/leaders in the field of actinide science. Bringing these scientists under the ASSSP forum afforded our students an opportunity they would otherwise not have. (See Appendix 2 – Lecture Series.)
- Designed an ASSSP poster to advertise the program.

Evaluation/Assessment

Feedback from summer participants of ASSSP continues to be supportive of the unique research experience and opportunity to use equipment not typically available at universities. Additionally, students are very pleased to have the opportunity to network among renowned researchers, a broad-and-diverse R&D population of researchers, and summer students. Informal polls of the students found that the summer lecture series was a good match with their school courses. A great deal of camaraderie was established among the students. They worked on their projects together and took weekend trips together. Evaluation of the students' research was determined in part by their participation in the Lab-wide Summer Student Symposium. The symposium required that the students prepare a poster presentation, based on their summer projects. The posters were very high quality. A few students chose to make oral presentations to their technical peers instead of through the symposium. This was also viewed as successful.



STEP interns are strongly encouraged to provide Web-based descriptions of their summer experiences (<http://step.llnl.gov/portfolio>). These descriptions are then made available throughout the entire NNSA complex for reference and to support recruitment efforts. FY01 is the final year of the ASSSP at LLNL.

Project Title: High-Energy-Density (HED) Physics Program

URL: http://step.llnl.gov/hed_physics/

Project Purpose

The purpose of the High-Energy-Density Physics Program is to prepare graduate and undergraduate students, who are U.S. citizens, for experimental, theoretical, and computational research in astrophysics, hydrodynamics, turbulence, plasma physics, and radiation/particle transport as applied to the evolution of complex systems. Student internships are offered during the summer and academic year for undergraduate thesis-research opportunities or graduate completion of master's degree and doctoral thesis research. Students chosen to be "HED Physics" interns are assigned a research mentor within A/X divisions with experience consistent with the research interests of the student. A and X divisions are part of the LLNL Defense and Nuclear Technology Directorate (D&NT).

Project Description

Recruitment materials were sent to all 800 accredited U.S. physics departments, through the American Institute of Physics. Student faculty advisors within these departments also received an e-mail message, which served as a supporting announcement of the HED Physics Program. In addition, a display advertisement was published in the journal "Physics Today," promoting the internship opportunities.

A dedicated recruiting Web site (http://step.llnl.gov/hed_physics) also provides an initial vehicle through which applicants may apply. A thorough review of all applicants by the HED Physics Program principal investigator determines the best research project for the student. An HED student recruiting Web site also has links to other STEP student internships, LLNL summer-employment opportunities, and links to the three NNSA DP labs and their respective stockpile-stewardship-program internship opportunities. A single point-of-contact, program administrator will be assigned to help student interns with all administrative issues, including hiring, clearances, etc.

The success of this year's pilot-program leads D&NT management to believe that former interns will increasingly recommend the program to their student peers and university advisors.

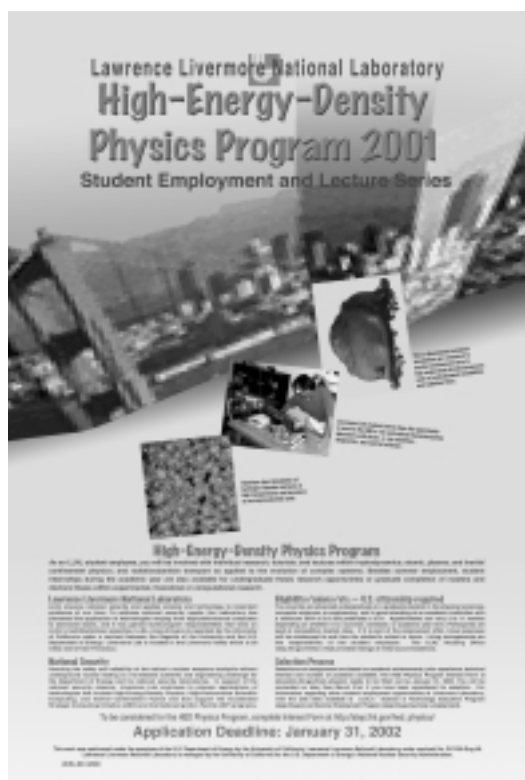
Benefits to the Missions of NNSA Defense Programs and LLNL

The primary mission of D&NT is to ensure national and global security by maintaining scientific and technical competence and leadership, in the absence of nuclear testing, in all aspects of thermonuclear weapon physics, design, and operation. This involves the application of theoretical, computational, and experimental physics to a wide range of topics relevant to national defense and security.

Partners

Laboratory

- A/X Division, Defense & Nuclear Technologies Directorate
- Physics Directorate
- LLNL National Security Program



High-Energy-Density Physics Program recruitment poster

Non-Laboratory

- The American Institute of Physics
- Accredited U.S. Physics Departments

Objectives

- Recruitment of scientists within the LLNL Defense & Nuclear Technologies directorate, with emphasis in the A and X divisions of D&NT.
- The D&NT A/X divisions will employ up to 30 student interns (upper-division undergraduate and graduate) per year in this program.
- Each of the five major research areas (astrophysics, hydrodynamics, turbulence, plasma physics, and radiation/particle transport) will have an LLNL researcher identified as the primary contact for answering initial student inquiries as to internship possibilities.
- Student's LLNL mentor will be chosen by HED Physics Program PIs to match both the student's and mentor's research interests to maximize future collaborations with the student's college/university and faculty advisor.
- Collaborations with academia will be modeled after the successful ASCI Alliances strategy.
- Student interns will be strongly encouraged to publish by providing a staff of A/X divisions artists and editors to facilitate the publication process for both papers and abstracts.

FY01 Accomplishments

- As a FY01 pilot project, with DP-“line” funding only, the HED Physics Program had 17 undergraduate interns and four graduate interns.
- Two of the four graduate summer interns are being offered employment as graduate students to complete their Ph.D. theses.
- Approximately half of the HED Physics interns, from the summer of 2001, will have their employment status changed from summer student to “indeterminate” student scholar. This allows the students to return at LLNL during school breaks and retain eligibility for a 2002 summer internship without being considered as new hires.
- Lecture series were given by scientists and engineers from D&NT and Nonproliferation, Arms Control, and International Security. After the lectures, students were offered time to socialize and talk with the speaker and other scientists one-on-one.
- The integration of students into regular group meetings provided them with a broader sense of how original research is performed.

FY01 Accomplishments *continued*

- As an experiment within the pilot project, some of the students gave 15-minute oral presentations on their research findings at the regular A/X division "work-in-progress" meetings. Approximately 50 scientists, as well as other interns, attended these meetings. The quality of preparation and the positive response to the presentations suggested that adding this activity should be a permanent part of the HED Physics program and could occur more extensively in the future.
- Social events were held for the interns. Approximately 80 individuals attended a welcoming BBQ picnic, held at the LLNL pool area. In addition, two softball games were played, where the teams were "students versus mentors."

Evaluation/Assessment

The success of this year's pilot program leads D&NT management to believe that there will be an increasing number of word-of-mouth recommendations by former program interns to their student peers and university advisors.

Evaluation will include bringing the HED Physics Program principal investigators, student mentors, and administrative point of contact together with the STEP staff to fully evaluate the FY01 summer pilot program. Students who will be selected for continuing opportunities with LLNL will be engaged for sponsorship of Ph.D. thesis research.

Project Title: Interns in Defense Technologies (IDT) (Previously known as Graduate Interns for Defense Technologies)

URL: <http://step.llnl.gov/idt/>

Project Purpose

The purpose of the Interns for Defense Technologies is to prepare undergraduate and graduate students, who are U.S. citizens, in nuclear, mechanical, electrical, and materials engineering with research opportunities leading to the completion of master's degree and doctoral thesis research. Upon completion of their 12-week internships and thesis research, the best of these students will be recruited for employment in Defense Technologies Engineering to work on DOE Defense Programs (DP) projects.

Project Description

Defense Technologies Engineering and STEP will collaborate with university academic advisors to identify qualified undergraduate, master's and doctoral students to participate in IDT. Other sources include summer employment students and STEP applicants and referrals from employee contacts.

Applicants will submit an electronic interest form, available from <http://step.llnl.gov/idt>. Applicant information will be distributed to key IDT researchers. Students will be selected for summer employment and matched to specific projects. IDT researchers are encouraged to contact applicants to discuss the student's interests and skills and assess their interest and possible match to the identified project. Once the student and researcher have mutually agreed on a project, a formal application is completed and submitted by the student, to initiate the security clearance process and formal job offer. The faculty advisor, where applicable, may arrange for the student to receive academic units for advanced laboratory or thesis research throughout the internship.

During the interim period, researchers are encouraged to maintain contact with the students, refer them to Web sites, and mail them additional information on their projects. These efforts enable the students to become part of the research teams even before they arrive at the Laboratory.

Upon their arrival, students work at the Laboratory for approximately 12 weeks on their projects in the Defense Technologies Engineering Division. In addition to the research experience, students are required to give an oral presentation to peers within their working group and summarize their experience in the form of an electronic portfolio. The portfolio briefly describes the student's academic major, the LLNL research project, perceived benefits by the participant, and any additional Web resources for more information. (Student portfolios are available at <http://step.llnl.gov/portfolio/>.) The electronic portfolio can be used as a reference on a resume. It also becomes a recruitment tool, when potential interns review the student-generated information on the LLNL NNSA DP projects.

NNSA Defense Programs/LLNL Mission Benefits

Defense Technologies Engineering Division (DTED) has two roles at LLNL. It is a programmatic organization in Defense & Nuclear Technologies (D&NT), responsible for LLNL-designed nuclear weapons, to ensure their integrity and reliability throughout their

stockpile life. It is also a Mechanical Engineering Division, primarily supporting the Stockpile Stewardship Programs.

The opportunity to pilot a program like IDT is invaluable, in that it both generates a pipeline of potential future employees and connects and strengthens possible collaborations with academia. DTED currently has 90 full-time equivalent (FTE) openings. With this many openings, multiple vehicles must be identified and used to be successful in hiring immediate FTEs. While LLNL management has focused on achieving the primary mission, a higher priority is being given to address the need for the next generation of Stockpile Stewardship critical-skill workers. The Science & Technology Education Program (STEP) is partnering with DTED to accomplish this objective at a time when the Laboratory faces retirements, workforce shortages, and turnover.

Management has acknowledged there are multiple benefits to an educational pipeline to the Engineering Directorate and Stockpile Stewardship. First, through the recruitment process, LLNL's stockpile-stewardship management is in contact with academic professors and department chairs. As a result, both students and faculty gain a glimpse of stockpile stewardship and programs at LLNL, which normally would not occur. Second, stockpile stewardship management and researchers must maintain their connections into the university if, for no other reason, than to retain their connection to advances in technologies. Having a science education program with leveraged funds legitimizes the activity of working with students in the development of this pipeline.

Partners

Laboratory

- Defense Technologies Engineering
- Engineering Directorate

Non-Laboratory

- University of California and other state and national campuses
- Associated Western Universities (AWU) Virtual Fair

Objectives

- Increase recruitment of IDT participants to 30 in FY02 from 16 in FY01.
- Include both undergraduate and graduate-level students who are U.S. citizens.
- Make offers of employment to the students participating in the internship project to work at LLNL or DP-managed laboratories.
- Strengthen and expand relationships with academic faculty, identify senior-thesis projects, increase awareness of IDT, and meet future work force needs related to stockpile-stewardship critical-skills.

FY01 Accomplishments

- Expanded program to include 16 participants.
- Increased DP-“line” to DP-“education” funding by approximately 2:1 in FY01, compared to 1:1 in FY00.
- Hiring three of the FY01 interns into the Engineering Directorate in FY02.
- Designed an IDT poster to advertise the program.

Evaluation/Assessment

Assessment input indicates that the majority of participants learn of LLNL internship opportunities through campus visits by Laboratory recruiters, through career fairs, and by faculty advice. While some students come to LLNL to experience the West Coast environment, most take part in the internship because of their interest in the research performed at the Laboratory.

Regarding specific research, most participants are surprised at the level of responsibility, minimal supervision given them, and the resources available to them—including a private office. Feedback on supervisors ranged from outstanding, very patient and supportive to “they are world-class guys!” Asked what skills students gained from the experience, many gained software skills in C and C++, Unix MPI, MathCAD, and ProDesktop, as an example. As with other STEP programs, the students commented on the uniqueness of the LLNL internship, which included opportunities to perform cutting-edge research and learn about topics not discussed in the classroom. Students also were impressed with their access to LLNL resources and facilities (micro-scale to macro-scale).

Because of the success of this internship over the past two summers, the Interns for Defense Technologies project will be part of the Engineering Directorate’s overall recruitment strategy and effort to meet the work force needs of the LLNL Stockpile Stewardship Program.



Graduate Interns in Defense Technologies recruitment poster

Project Title: Internships in Terascale Simulation (ITST)

URL: <http://step.llnl.gov/itst/>

Project Purpose

The purpose of the Internships in Terascale Simulation Technology is to prepare graduate and advanced undergraduate students for employment as computational scientists. This is done by providing hands-on experience using Massively-Parallel Processing (MPP) systems; mentoring from expert computational scientists; and offering specialized enrichment instruction in computational mathematics and scientific visualization techniques, as provided by a dedicated Livermore Computing training staff, special guests, and prominent Institute for Terascale Simulation (ITS) scientists. This instruction includes topics not generally available in university curricula, centered around interdisciplinary (mathematics/computer science/engineering) approaches necessary to work with terascale parallel processing machines. Participation in this instruction is open to all LLNL and neighboring Sandia National Laboratories (SNL) scientists.

Project Description

The Accelerated Strategic Computing Initiative (ASCI) Institute for Terascale Simulation (ASCI-ITS) research mission requires computational scientists to have knowledge of the physical applications used in ASCI, computer architecture and numerical mathematics. This proposal offers six research topics, two from each of these three corresponding ASCI-ITS and Center for Applied Scientific Computing (CASC) research responsibilities.

Computer science

- **Exploration of terascale data sets:**
Algorithmic techniques and software tools enabling the effective use of the terabytes of data generated by applications running on the ASCI platforms.
- **Parallel programming paradigms:**
The ability to simulate laser plasma interactions by solving the underlying governing equations on parallel computers, using parallel adaptive mesh refinement.

Computational Mathematics

- **Adaptive mesh refinement for Partial Differential Equations:**
A simulation methodology that provide both spatial and temporal refinement to focus computational resources in portions of the computational domain to maximize accuracy for given resources of time and memory.
- **Scalable methods for coupled nonlinear systems:**
Scalable algorithms and implementations for solving nonlinear differential equations discretized on three-dimensional meshes having upwards of one billion spatial zones, including multilevel and Newton-Krylov techniques.

ASCI Applications

- **Simulation of transport:**
Modeling of time-dependent and steady-state transport of radiation in complex media.

- Simulation of lasers and plasmas:
Modeling of time-dependent phenomena involving lasers, plasmas, and laser-plasma interactions in devices of interest to the NNSA.

All six of the proposed topics can be supported or the number can be scaled to best meet the immediate critical skills/DP-mission needs. In general, up to four students will participate in each of the topic areas. The skills of the participants will ultimately determine the support to any given project.

Participants will be recruited in the fall and early winter. Keys to a successful LLNL recruitment strategy include having Laboratory employees visit students and faculty on campus and encouraging numerous LLNL visits by students. Targeted applicants are primarily postdoctoral students. This requires a long-term investment of time and attention, to build relationships with likely advisors.

Applicants are chosen from ASCI Alliance academic institutions, the STEP and summer applicant pool, and through individual referrals and contacts. Once chosen, interns will be integrated into research teams and assigned mentors.

In addition to the research experience, students are required to participate in the ITST Lecture Series. (Refer to this Web page: http://step.llnl.gov/itst/itst_schedule.html.) This series provides students with a common curriculum. The interns also give oral presentations to peers within their working group and summarize their experiences through “electronic portfolios.” Each portfolio briefly describes the student’s academic major, the assigned LLNL research project, the perceived benefits by the participant, and any additional Web resources for more information. (Student portfolios are available at <http://step.llnl.gov/portfolio/>.) The electronic portfolio can be used as a reference on the student’s resume. The portfolios also are used as a recruitment tool. Potential interns can easily access the student-generated information about the LLNL NNSA Defense Program projects, which may encourage applications.

NNSA Defense Programs/LLNL Mission Benefits

Because there is an increasing national demand for trained computational scientists (especially at the Ph.D. level) and U.S. schools are producing too few computational scientists today, we face a future work force shortage. Even within the traditional academic discipline of computer science, most students are interested in commercial computing, not scientific computing. ITST addresses this gap by encouraging and equipping students to develop backgrounds in terascale simulation.

Partners

Laboratory

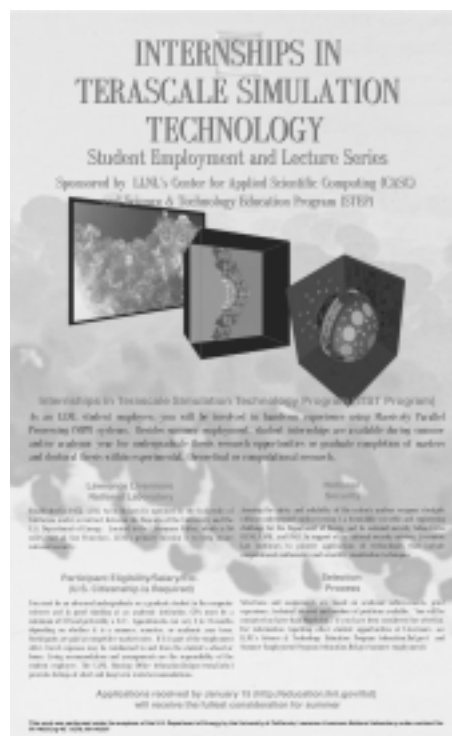
- Partners within LLNL include management and researchers from the Center for Applied Scientific Computing (CASC), the Institute for Terascale Simulation, and the Institute for Scientific Computing Research (ISCR).

Non-Laboratory

- Professional societies including the Society for Industrial and Applied Mathematics, the IEEE Computer Society, and the American Physical Society have recently created activity groups in computational science and engineering.

Objectives

- Recruit 30 participants for FY02, with an emphasis on graduate students.
- Recruit qualified ITST students to seek employment at LLNL as computational scientists.
- Reduce the training time of new Ph.D. graduates hired at LLNL as computational scientists.
- In addition to the research experience, students are required to participate in the ITST Lecture Series. (See http://step.llnl.gov/itst/itst_schedule.html.) The lectures provide the students with a common curriculum. The students give oral presentations to their peers within their working groups and summarize their experiences in the form of electronic portfolios. Each portfolio briefly describes the student's academic major, the LLNL research project, perceived benefits by the participant, and any additional web links for more information. (Student portfolios are available at <http://step.llnl.gov/portfolio/>.) The electronic portfolio can be used as a reference on a resume. The online portfolio also becomes a recruitment tool for students, in that students may access intern-generated information about the LLNL NNSA DP projects, which may encourage them to apply for the program.



Internships in Terascale Simulation recruitment poster

FY01 Accomplishments

- Interns are making genuine contributions to ASCI program goals.
- Interns have been hired as employees—two in FY00 and one in FY01.
- Seven students in FY00 continued working during the school year on collaborative projects and six in FY01 did the same.
- While nine students in FY00 returned for the summer of 2001, 16 students from this summer indicated they hope to return in the summer of 2002.
- Based on FY00 feedback, the ITST Lecture Series was tailored to include more career-development elements and moved to a time more convenient for students.
- Designed an ITST poster to advertise the program.

Evaluation/Assessment

Evaluations are ongoing and include a variety of instruments, including reflective feedback, focus meetings with the supervisors and students, personal meetings, questionnaires, seminar

discussion groups, results of the various classes, student products and final oral presentations.

Program success is measured in part by the creation of long-term relationships initiated by the program. During the past few summers, nearly every student has wished to return and as a result, has been placed in an indeterminate status for future employment possibilities. Two ITST interns were hired in FY00 and another two were recently hired in FY01. ITST has become an essential element of CASC's overall training and recruitment strategy, as well as a cost-effective means of accomplishing research.

Project Title: System Administration Computer Support (SACS)

URL: <http://step.llnl.gov/sacs/>

Project Purpose

The goal of this project is to develop and implement a comprehensive program that integrates classroom learning with work force preparation and training in support of computer-science systems administration for national security at the DOE Laboratories. LLNL technical staff will engage two-year and four-year academic institutions to collaborate in establishing a curriculum and certification program in addition to internships, to train students so that they may be qualified for entry-level skilled technical positions.

Project Description

LLNL technical staff will start expanding the pilot program by engaging additional local two-year and four-year academic institutions. A collaborative pilot program was initiated at Las Positas College in Livermore, California, to establish internships to train students so that they may be qualified for entry-level, skilled-technical positions. One of the objectives in FY02 is to increase the LLNL placements to eight to 10 participants. As in the pilot year and as part of the recruitment strategy, LLNL Systems and Network Department staff will attend job fairs, serve as guest speakers at classes to attract students, tap into faculty and students for recommendations. Recruitment is year around, as participants can work “co-op” or part time or in nearly any arrangement while they are attending their community college. Lab courses and classes are also made available to the students to further their educational, “hands-on” experience.

Milestones for FY02 will include completion of the design and implementation of the certification program and its expansion into other schools. Project challenges will be in the reception to the certification program and constraints in placing participants without higher security clearances.

NNSA Defense Programs/LLNL Mission Benefits

Over the past year, LLNL (through the Systems and Network Department) has had between 15-30 positions open at any given time for technical support personnel. This is in addition to the more than 30 individuals hired by SND in FY01. More than 80% of these positions have been in organizations directly related with Defense Program (DP) funding. The others are in support organizations of those interacting with DP. The technical staff being hired needs to have the specific skills and experience as that offered to students at LLNL. This experience is not readily obtained in outside industry (e.g., support for the Macintosh platform). Getting local community colleges to teach the courses would also help LLNL meet its needs. It is recognized that, in order to meet the growing computing needs of LLNL, the Laboratory must make efforts to “grow its own” staff.

System administration/computer support has been recognized as a critical skill within the Laboratory, because everyone has a desktop computer. In addition, the LLNL Technical Salary Committee (TSC) has approved three salary actions to attract and retain personnel over the last three years (FY99, FY00, FY01). The actions included movement of the top of the salary range by over 20% total over two years (FY00, FY01), and special salary allocations authorizing the



System Administration Computer Support recruitment poster

distribution of additional dollars specifically for systems and network technical classifications (FY99, FY00, FY01). System administrators are difficult to recruit because of the Laboratory's proximity to Silicon Valley and other high-tech industries. These actions were taken to overcome some of our "competition" for skilled personnel.

Partners

Laboratory

- Computation Directorate in support of the Accelerated Strategic Computing Initiative
- National Ignition Facility (NIF) program
- Chemistry and Material Science Department
- Laboratory Services Directorate
- Systems and Network Department

Non-Laboratory

- Las Positas College, with expansion to Chabot College, Ohlone College, and Modesto Junior College

Objectives

- Expand the program to other local community colleges and will continue to increase placements to eight to 10 participants because the demand for SACS participants has increased.
- Provide job placement assistance for students completing the certificate program, including offering help with job searches and the application process, and locating employment opportunities.
- Provide co-op work experience programs for students to develop skills using school-course material with job duties.
- Provide faculty training and internships to encourage the transference of technology skills into the classroom and increase student understanding of work force needs and concerns.

FY01 Accomplishments

- Hired an intern as a full-time equivalent (FTE) in an intermediate level (593.2) position, a systems and network technologist. Our initial recruiting goal was for entry-level (593.1) job classification.

FY01 Accomplishments *continued*

- Hired the remaining FY00/01 students directly into technical programs (continuing as students) with 100% funding by the program.
- FY01 student under consideration for LLNL FTE position.
- Identified faculty and process to design certification program. Initiated discussion of classes for program and identified skills and knowledge students should obtain.
- Participated in the Las Positas College Career Fair, May 2001.
- Designed a SACS poster to advertise the program.

Evaluation/Assessment

Evaluations are ongoing and include a variety of instruments, including reflective feedback, focus meetings with the supervisors and students, personal meetings, questionnaires, seminar discussion groups, and results of the various classes. Program success is further measured by growth of the program through increased placements. Presently, one participant from FY01 has already been hired into an FTE position at an intermediate-level, based on the experience gained from the internship. The remaining two were converted to term hires. Additionally, at least one applicant who participated in a recruiting fair is being considered for employment at LLNL.

Section 2 – Military Academy Research Associates/ROTC

STEP Contact: Barry Goldman, (925) 422-5177, goldman1@llnl.gov

Introduction

To ensure our nation's security, the United States requires a scientifically and technically literate work force for both civilian and military personnel. In the case of the military, it is important that officers are also knowledgeable about the science and technology capabilities of the major DoD and DOE laboratories and these capabilities can be utilized to improve the capabilities of the military services.

Working with the LLNL National Security Office, STEP manages a program called Military Academic Research Associates (MARA) and the Reserve Officer Training Corps (ROTC) Interns. MARA is also a partnership with the DOE NNSA national laboratories, thereby leveraging the rich scientific and technical base of all three—LLNL, Los Alamos National Laboratory, and Sandia National Laboratories. In an effort to expand the DOE/DoD connection, STEP has developed an ROTC internship program, as a spin off of the MARA program. This internship offers opportunities to ROTC cadets and midshipmen from within the state of California and throughout the entire nation.

While MARA appointments are typically a four- to six-week appointment during the summer, the ROTC internships are provided throughout the year for undergraduate and graduate cadets/midshipmen. In either program cadets/midshipmen work in areas such as the National Ignition Facility, stockpile stewardship, advanced manufacturing, high-performance computing (ASCI), non-proliferation and arms control, intelligence assessment, and other projects that represent programs focusing on national-security issues.

MARA/ROTC interns become aware of, and participate in, the LLNL national-security mission. They will:

- Immerse themselves in their research projects (four to six weeks for MARA and 12 weeks for ROTC interns)
- Participate in seminars/tours
- Complete electronic portfolios with abstracts
- Deliver technical presentation to peers

While at LLNL,

MARA interns:

- Continue to receive military pay
- Are provided accommodations and local transportation, and
- Are reimbursed for transportation to LLNL as well as per diem

ROTC interns:

- Are paid salaries at competitive market rates
- Are reimbursed for transportation to and from the student's school or home
- Are responsible for living arrangements are the responsibility of the student employee

MARA/ROTC cadets and midshipmen are required to summarize their experience in the form of an electronic portfolio. The portfolio briefly describes the Interns major, military institution, LLNL research project, perceived benefits by the participant, and any additional Web resources for more information. The URL is <http://step.llnl.gov/portfolio/>, with a link to Military Academic Research Associates (MARA). In FY01, there were 21 MARA and four ROTC interns at LLNL, as well as two faculty members from West Point.

Applications may be completed and submitted through a single Web site for all the participating laboratories. The URL is <http://step.llnl.gov/mara>, with a link to "Application." Applicants must be U.S. citizens with a grade point average of 3.0 or higher. For an internship during the summer months, applicants must apply by January 31 to receive full consideration. The majority of hiring departments make their selections in March through May. The final deadline date for submitting an "Interest Form" for summer employment is March 31.



West Point Academy cadet Dennis Mackin gives an oral presentation to his research peers at the end of his assignment.

Project Title: Military Academic Research Associates (MARA)

URL: <http://step.llnl.gov/mara/>

Project Purpose

The two goals of the Military Academic Research Associates (MARA) project are to:

- Foster a stronger relationship with the military and enhance the tie between the Department of Defense, Lawrence Livermore National Laboratory, the Department of Energy, and the Office of Defense Programs, and Address the Chiles Commission.
- Satisfy future work force needs, following military commitment or retirement.

LLNL has been working with the undergraduate military academies, as well as several of the graduate institutions, to provide internship opportunities for military cadets/midshipmen. The military cadets and midshipmen are given the opportunity to participate in ongoing, collaborative, multi-disciplinary teams that are pursuing scientific and technical solutions to some of our nation's most challenging problems, many critical to national defense.

Project Description

Cadets/midshipmen are recruited through partnerships with the Air Force Academy, the Naval Academy, the West Point Academy, and others. Thus far, we have successfully partnered with all of the aforementioned academies to provide summer experience tours. We will aggressively recruit projects for cadets/midshipmen in the winter and these will be communicated to students in January through March. Cadets/midshipmen bid on assignments in February with final decision on their summer tours being resolved in March and April. Discussions are also ongoing to encourage academy faculty to experience research at LLNL.



United States Air Force Academy cadet Amy Schultz works with peer researchers in the Health & Ecological Assessment Program.

A Web site (<http://step.llnl.gov/mara>) provides links to the interest form, examples of past military assignments (electronic portfolio) and MARA briefings, program requirements and criteria to qualify. LLNL hosts 20 to 25 cadets and midshipmen plus a few faculty during the summer. Each participant spends from four to six weeks working on a dedicated project. In addition to completing their research assignment and attending all military briefings (in uniform), participants are required to give their technical peers a closeout briefing at the conclusion of the tour and complete an electronic portfolio. (See Appendix 3 – Student Presentations: <http://step.llnl.gov/portfolio/>.)

The respective military academies continue to pay the cadets' or midshipmen's salary, and LLNL funds the interns' travel, lodging, shared rental car, and per diem.

Partners

Laboratory

- Defense and National Security Office within LLNL
- Los Alamos National Laboratory
- Sandia National Laboratories/New Mexico
- Oak Ridge National Laboratory
- Idaho National Environmental and Engineering Laboratory

Non-Laboratory

- Air Force Institute of Technology (AFIT)
- Naval Postgraduate School (NPS)
- U.S. Merchant Marine Academy (USMMA)
- U.S. Naval Academy (USNA)
- U.S. Coast Guard Academy (USCG)
- U.S. Air Force Academy (USAFA)
- The Citadel
- Virginia Military Academy (VMI)
- West Point Academy (USMA)



Naval Academy Midshipman Derek Smith works in the Biology and Biotechnology Research Program's Directorate in the Computation Biology Group.

Objectives

- As stated by the Deputy Associate Director, Military Affairs, National Security Office, "Today's cadets and midshipmen are the next generation of leaders for their respective services. What they learn at a DP lab will help shape their future ability to understand the broader defense capabilities of the country—including those that reside at Lawrence Livermore National Laboratory."
- Establish a pipeline for recruitment, following the MARA military commitment or retirement.
- Expose cadets/midshipmen and graduates to military research at LLNL.
- Facilitate civilian/military faculty and research collaborations.
- Ensure that cadets/midshipmen benefit from the technology experience (and techniques gained), the networking, publications, and exposure to issues of national defense.

FY01 Accomplishments

- Designed a MARA poster for recruitment purposes.
- Worked with the LLNL Technical Information Department to design a MARA/ROTC poster series, which was displayed in front of Bldg. 111.
- Provided NIF tours to the MARA briefings to allow all participants to experience the facility.
- Added a tour of Site 300 tour, as requested by the summer MARA participants.
- With the onsite STRATCOM and DOE liaison officers, coordinated a “Flag General Luncheon” on June 6, which included several distinguished military and civilian personnel:
 - RADM Miles B. Wachendorf, CNO N-51, division head for policy and plans
 - RADM John F. Shipway, USN (Retired)
 - Dr. Theodore M. Hardebeck, head science advisor for US STRATCOM
 - Dr. Thomas O. Hunter, Sandia National Laboratories, head of Weapons Directorate
 - Dr. Harold Agnew, former director of Los Alamos National Laboratory



MARA Internship Recruitment poster

Evaluation/Assessment

The majority of participants (83%) learned of the MARA program from their academy point of contact, an academy flier, peers or an LLNL representative briefing at their respective academy. While 28% chose a national laboratory because of its reputation, another 28% chose LLNL because of geography, and still another 28% because they had family in the area. One hundred percent of the participants agreed that their interests matched their research project as well as related to their academic background and education. When asked about work experience, one respondent said, “I’m very impressed by the level of inter-departmental cooperation on research issues. Any time I had questions or needed additional information, I found lots of assistance.” Regarding what one gains from such an experience, one intern said, “I saw how a real-world problem could draw on so many different engineering concepts. You don’t need to be an expert in everything. You just need to have a good background that you can draw upon to look up and solve engineering problems. It helped me decide what I would like to study in the future.”

When cadets and midshipmen were asked about the uniqueness of a tour at a national security laboratory, they typically responded with 1) the people and 2) resources available at LLNL. A number of participants commented

on the differences when working at a civilian facility and the dedication and professionalism of the employees. After spending the internship in a specific research area, some felt there were no opportunities at their academy, within their field of study or at least not in a multi-disciplinary manner, to perform similar research.

In summary, one of the faculty members who interned at LLNL best described the participant consensus, “This is a great program that can be expanded upon. I would recommend an aggressive advertising campaign to attract our future military leaders. After a summer here, I am confident that our future officers will have a better understanding of our national lab system, as well as the uses of technology on future battlefields.”

Project Title: Reserve Officer Training Corps (ROTC) Interns

URL: <http://step.llnl.gov/rotc/>

Project Purpose

The Reserve Officer Training Corps Interns help to foster a stronger relationship with the military and enhance ties among the Department of Defense (DoD), Lawrence Livermore National Laboratory, and the National Nuclear Security Administration (NNSA). LLNL has been working with the military academies and recently expanded to include the ROTC to provide internship opportunities for cadets and midshipmen. Cadets and midshipmen are given the opportunity to participate in ongoing research on multidisciplinary teams, pursuing scientific and technical solutions to some of our nation's most challenging problems, many critical to national defense.

Project Description

Cadets and midshipmen are recruited through their respective military ROTC detachments and units on a national and regional level. Additionally, a Web site is available to allow any ROTC cadet or midshipmen to apply electronically, similar to any university student applying to a STEP project.

STEP designed an ROTC Intern brochure, which is being distributed nationally. The Army ROTC has requested copies to distribute at least three copies to every unit in the nation. The Navy ROTC has provided the addresses of all their units such that a cover letter has been sent to each unit with copies of the brochure. STEP staff is still in discussions with the Air Force ROTC as to the distribution to Air Force Detachments.



University of Notre Dame ROTC Midshipman Jennifer Hughes works in the Laser Science and Technology Program.

ROTC cadets and midshipmen apply before March 15, using the STEP Web site (<http://step.llnl.gov/rotc>). Applicants are referred to individual researchers based on their academic credentials, expressed interest, grade point average and, of course, being a member in good standing at an academic institution and the ROTC. Researchers are encouraged to contact the student to discuss potential projects and assess the student's skills and interest. When a match is identified between a student and researcher, an official application and a security questionnaire are sent to the candidate. Once the application, security questionnaire and transcript are received, a "request to hire" form is processed along with the security clearance application (which is typically taking about six weeks to process). Once the entry clearance is authorized, reciprocity can be then initiated, to transfer the cadet or midshipman's DoD secret clearance to a LLNL DOE "L" clearance. At this point, the student can be brought into the Laboratory to begin his/her assignment.

In the meantime, LLNL researchers are encouraged to maintain contact with their candidates, by forwarding literature via the mail or through Web sites. This allows the

students to come up to speed in their areas of research and to feel part of the teams until they are able to start their assignments.

Partners

Laboratory

- Defense and National Security Office within LLNL
- Los Alamos National Laboratory
- Sandia National Laboratories/New Mexico and California
- Oak Ridge National Laboratory
- Idaho National Environmental and Engineering Laboratory

Non-Laboratory

- U.S. Air Force ROTC
- U.S. Naval ROTC
- U.S. Military ROTC
- The Citadel
- Virginia Military Academy (VMI)



Washington State University Army ROTC cadet Michelle McCaffney assists Lori Zeller in the LLNL BioSecurity Support Lab.

Objectives

- As stated by the Deputy Associate Director, Military Affairs, National Security Office, “Today’s cadets and midshipmen are the next generation of leaders for their respective services. What they learn at a DP lab will help shape their future ability to understand the broader defense capabilities of the country – including those that reside at Lawrence Livermore National Laboratory.”
- Establish a pipeline for recruitment following the military commitment or retirement.
- Expose cadets/midshipmen and graduates to military research at LLNL.
- Facilitate civilian/military faculty and research collaborations.
- Ensure that cadets/midshipmen benefit from the technology experience (and techniques gained), the networking, publications, and exposure to issues of national defense.

FY01 Accomplishments

- Hosted 85 cadets and midshipmen and their officers for ROTC Days on April 18, 2001.
- Designed an ROTC poster for recruiting use.
- Designed an ROTC Intern brochure, to be distributed nationally to all military ROTC detachments and units.

FY01 Accomplishments *continued*

- Worked with the LLNL Technical Information Department to design a MARA/ROTC poster series, which was displayed in front of Bldg. 111.
- Recruited four ROTC (Washington State, Baylor University, Notre Dame and San Diego State University) for summer 2001 internships. An Army ROTC from San Diego State will continue to work at LLNL in a “term” capacity until admitted to medical school next year and the Navy midshipmen from Notre Dame will return during holidays and breaks to continue to support her project.
- Coordinated by the onsite STRATCOM and DOE Liaison Officers, a “Flag General Luncheon” was held on June 6, which included several distinguished military and civilian personnel:
 - RADM Miles B. Wachendorf, CNO N-51, division head for policy and plans
 - RADM John F. Shipway, USN (retired)
 - Dr. Theodore M. Hardebeck, head science advisor for US STRATCOM
 - Dr. Thomas O. Hunter, Sandia National Lab, head of Weapons Directorate
 - Dr. Harold Agnew, former director of Los Alamos National Laboratory
- NIF tours to the MARA/ROTC briefings to allow all participants to experience the facility.
- Added a Site 300 tour, as requested by the summer MARA/ROTC participants.

Evaluation/Assessment

The majority of participants were surprised to have their own office and all recognized the benefits of networking. When asked about mentor relationship, one cadet responded, “After meeting my supervisor, I’m confident that I’ll be asking for advice and counsel for many years to come.” When asked about the directions provided by their supervisors, another cadet said, “A lot of my project was left up to me, which was a good thing. However, this meant it took two weeks to figure out on my own what limitations I had.”

Participants learned or refreshed their skills in programs from Word and Excel to Unix and Linux. Other skills gained were more specific to their project. Furthermore, when asked how this experience influenced their military career interests, a common response was, “I feel that it is too early to say what I want with my military career at this point, but this experience had definitely given me a lot more to think about.”

When asked about networking, one intern responded with, “I got to be good friends with my roommates. I plan to see them sometime next year. I also plan to keep the phone numbers of the senior officers and scientists at the Lab in case I need to reach them.”

In summary, one ROTC cadet’s closing statement best exemplifies the value of the program to a ROTC intern: “This program is amazing. I learned more this summer than I did taking a year’s worth of organic chemistry. The difference was the environment. Being engulfed in a scientific community fostered my desire to learn and ignited my curiosity about the infinite chemical and

biological applications in our world. Being adopted into such an ambitious and scientifically creative atmosphere instilled in me a sense of enlightened work ethic... a self-motivated pursuit of knowledge, rather than the mindless regurgitation of facts that still plagues most college students. And while funding scientific breakthroughs is still important, the absolute best investment for national security is exposing my generation to the technologies we are responsible to continue when America's future is in our hands."

Military Academic Research Associates (MARA) ROTC Day

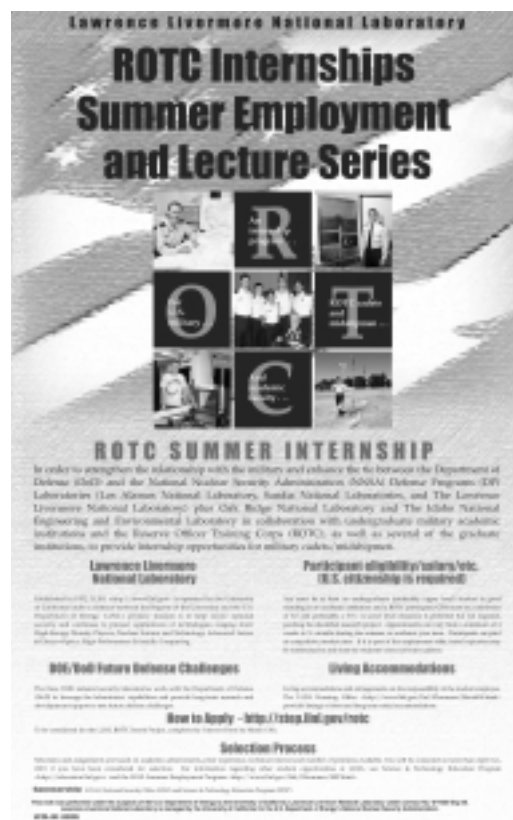
URL: <http://step.llnl.gov/rotc/>

The 4th annual ROTC Day took place on April 18, 2001. All California ROTC detachments and units were invited to participate in the event. Approximately 85 cadets and midshipmen and their officers attended, which made this year's ROTC Day the largest held.

The Laboratory's ROTC Day continues to be a part of the National Security Office efforts to strengthen the relationship between LLNL and the Department of Defense. Lawrence Livermore National Laboratory and STEP are helping to shape the future workforce by leveraging the rich scientific and technical base of the Laboratory. ROTC Day is component of the ROTC Intern project where cadets and midshipmen spend internships at the national security laboratories (LLNL, LANL, and SNL) and has expanded to include Oak Ridge National Laboratory and the Idaho National Engineering & Environmental Laboratory. The ROTC Intern project is a spin off from the Military Academic Research Associates (MARA) program. The ROTC Intern provides hands-on internship research opportunities to undergraduate cadets and midshipmen. ROTC Interns also offers opportunities to conduct thesis research and facilities faculty research appointments.

Based on the success of last year, once again the ROTC Day included a panel discussion on future careers in the military and the role that science and engineering plays in it. After the panel discussion and additional presentations on LLNL DoD/military research, participants toured one of the following areas:

- Tour 1: High-Explosives Applications Facility and the National Ignition Facility (NIF)
- Tour 2: Chemical and Biological Non-Proliferation Program, DoD Technologies, and a mini-tour of NIF
- Tour 3: Conflict Simulation Lab (to include the Joint Conflict and Tactical Simulation, the National Atmospheric Release Advisory Center, and a mini-tour of NIF)



ROTC Internships recruitment poster

Although Dr. Edward Teller (who is 93 and enjoys meeting with students) was scheduled to join the ROTC cadets, midshipmen and their officers for a luncheon, he was ill and unable to participate.

Information on this year's ROTC Day, including the invitation, agenda, registration for the day and the tours, tour descriptions, and biographies of those scheduled to participate on the panel, can be found at the ROTC Web site: <http://step.llnl.gov/rotc>.

Based on last year's ROTC Day, the schedule was lengthened to allow more time for tours. General input from this year's participants suggested that fewer briefings should be scheduled and more tours should be offered.

Section 3 – K-12 Student Projects and K-14 Educator Partnerships

STEP Contact: Richard Farnsworth, (925) 422-5059, farnsworth1@llnl.gov

URL: <http://step.llnl.gov/>

Introduction

STEP leads the Laboratory's science education activities through K-12 student projects and K-14 educator partnerships by

- Enlightening K-12 students about college opportunities that allow for future careers in science and technology, especially those of special interest to Lawrence Livermore National Laboratory (see page 43)
- Partnering with local, regional, and state K-14 educators to leverage the Lab's science and science education programs to help contribute to the quality of science teaching in California (see page 51)
- Collaborating with the UC Davis and UC Merced campuses to create the Edward Teller Education Center at the UC Davis' Department of Applied Sciences adjacent to LLNL (see page 63)

In FY01, STEP's student and educator projects engaged approximately 9,300 students and 1,200 teachers, as detailed in the tables below.

K-12 Student Projects in FY01	Number of participants
COSMOS-California State Summer School for Mathematics and Science	12
Expanding Your Horizons (three conferences)	1,400
Explorer Post	50
Fun With Science	5,700
Future Scientists and Engineers of America	75
Groundwater Assessment Monitoring Program (GAMA)	60
Math Challenge	50
Science on Saturday	1,700
Student Research Academy	12
Tri-Valley Science and Engineering Fair	250
Approximate total	~9,300

K-14 Educator Partnerships in FY01	Number of participants
Computer Technology Workshops	300
Crystals in the Classroom (teacher development)	2
Educational Partnerships	400
Edward Teller Science and Technology Symposium	120
GEMS–Great Explorations in Math and Science	150
Laser Science and Optics in the Classroom	30
Promoting Achievement through Hands on Science	60
UC/Community College/Central Valley Education	120
Approximate total	~1,200

STEP's science education and educator partnerships are supported with funding from the LLNL General and Administrative (G&A) Distributed Budget. Additional education and partnership information can be acquired at the following Web sites:

- STEP home page <http://step.llnl.gov>
- STEP educator resources http://step.llnl.gov/step_educator.html
- STEP education outreach http://step.llnl.gov/step_outreach.html

K-12 Student Projects

Project Title: COSMOS – California State Summer School for Mathematics and Science

URL: <http://www.cosmos.ucdavis.edu/>

Project Purpose

The California State Legislature established a program called COSMOS, with a mission to motivate the most creative minds of the new generation of prospective scientists, engineers, and mathematicians, who may become future leaders of California, the nation, and the world. The program is designed to create a community of students who participate in an intensive academic experience delivered by distinguished educators, scientists, and researchers.

Project Description

The California State Summer School for Mathematics and Science, known as COSMOS, is an academic, four-week, residential program for talented and motivated students completing grades 8-12. STEP collaborates with the UC Office of the President and University of California, Davis, to provide students with hands-on science activities at LLNL.

Each student's COSMOS schedule is built around a cluster consisting of two or three science or math-based courses and a science writing or communications course. On a typical day, COSMOS students attend special lectures, take courses, or participate in labs or course-related field trips. Recreation and study groups are built into the evening and weekend schedules. Special activities and supervised field trips are planned for the weekends. Social and cultural events and friendly competitions, including chess tournaments, have been popular in the past. Evening activities, such as COSMOS jeopardy, dance lessons, and a student-organized talent show, are highlights, as well.

STEP collaborated with UC Davis to provide the optics cluster consisting of 12 students with hands-on experience in science areas at Lawrence Livermore National Laboratory. The students visited LLNL one day per week for four weeks. Each visit included a workshop in four separate science areas conducted by LLNL scientists. This presentation included hands-on learning activities and was followed by a tour of the research facilities corresponding to the instruction. The students participated in radiocarbon dating, optics, biotechnology and groundwater monitoring and vulnerability assessment.

Partners

- Edward Teller Education Center (ETEC)
- UC Office of the President
- UC Davis



Lab technician, Joel Speth, demonstrates how lasers are used to COSMOS students.

Objectives

- Broaden students' understanding of science and how it is used to solve problems.
- Provide hands-on activities to make students' exposure to science more interesting.

FY01 Accomplishments

As a result of the initial experience of a group of COSMOS students visiting LLNL, the COSMOS Board of Directors has suggested they would like all the UC Davis COSMOS students to visit LLNL twice during their four-week program.

Evaluation/Assessment

The evaluation and assessment of the project is conducted by the COSMOS administration.

Project Title: Expanding Your Horizons (EYH)

URL: <http://step.llnl.gov/eyh/>

Expanding Your Horizons conferences are one-day events for young women, grades 6-12, designed to encourage them to consider careers in math and science-related fields. EYH depends on volunteers who act as enthusiastic role models. The conferences offer hands-on activities and promote the importance of science, mathematics, engineering, and technology. Two of the three annual conferences are conducted in areas that have a large population of underrepresented students. EYH places a heavy emphasis on encouraging their participation.

During this year, STEP contributed hands-on workshops in optics and robotics to introduce students to technology that contributes significantly to their lives and provides an introduction to potential careers in those fields. Three conferences were held serving three California counties: Alameda, Contra Costa, and San Joaquin. An estimated 1,400 students and 30 LLNL employee volunteers participated in the three events: San Joaquin – 600; Tri-Valley, San Ramon – 400; Mills College – 400.

Project Title: Explorer Post

The Science and Technology Explorer Post 957 is under the “career awareness” auspices of the Boy Scouts of America. The Post is “chartered” by STEP at Lawrence Livermore National Laboratory. Members consist of college-preparatory high school students who work on “projects” such as Web page development, Excel spreadsheets, and fiber optics demonstrations. Some LLNL volunteers act as advisors to the students on these projects while others provide training, project demos, and tours for the Explorers. Recently, these Explorers began learning to use optics and lasers as a part of their experience. The goal of the program is to encourage the members to stay focused on pursuing a college education by providing opportunities for students to work on projects related to their areas of study and interest.

The students completed projects during the course of the year. These projects included developing individual Web pages, conducting optics experiments, and designing a magnetometer. A total of 49 students and five LLNL employee volunteers participated in the Explorer Post events.

Project Title: Fun With Science (FWS)

URL: <http://step.llnl.gov/fws/>

The Fun With Science program offers engaging, hands-on, standards-based science demonstrations—focusing on chemistry, physics, changes-of-state, gases, pressure, and environmental-science activities—for students, teachers, parents, and public groups. The activities are conducted by numerous LLNL volunteers from various scientific disciplines and are held in schools and in conjunction with science events throughout the Livermore area, the Central Valley, and the Foothill counties of California.

This program addresses requests from educators and the public for science-related presentations in the classroom and at community events. It introduces the participants to how science and technology play a significant role in their lives. The activities encourage students to become more interested in and curious about science. Fun With Science is also incorporated into the PATHS program, which provides teacher training in science curriculum units, which correlate to the presentations with students. It is primarily focused on supporting elementary-school science teaching, as required in the California State science standards.

FY01 Accomplishments

- Offered demonstrations to 5,700 teachers, students, and parents during the school year.
- Registered and involved more than 60 LLNL employees as Fun With Science presenters.

Project Title: Future Scientists and Engineers of America (FSEA)

URL: <http://www.fsea.org/>

Future Scientists and Engineers of America has been in existence for seven years and is based in southern California. It is a national non-profit organization that provides the structure, project material, documentation, and workshop training necessary to establish after-school technology clubs. The program is structured around scientists mentoring a classroom of students (grades 4 through 12) on a project chosen by the scientist.

STEP supported 75 students who chose to participate in Future Scientists and Engineers of America.

Project Title: Groundwater Assessment and Monitoring Program (GAMA)

Project Purpose

The GAMA project provides students with a project-based learning opportunity, using groundwater monitoring as the basis of the project.

Project Description

Tri-Valley Regional Occupational programs—and its environmental-science and technology program at Livermore (Livermore Joint Unified School District) and Foothill (Pleasanton Unified School District) high schools—has acted as a “beta tester” for curriculum and science applicability with GeoTracker. GeoTracker is a joint project with LLNL and the State Water Board, the LLNL GAMA project, and local water agency, Zone 7. This model of incorporating teacher/educational institution input with national-laboratory and local business-agency missions will be taken to the Merced, Stanislaus, and Tuolumne county areas. The GAMA Project used student work in digital documentation and data gathering.

Because this is a statewide project, teachers and their schools are ideal community conduits for local input and public education. Delhi High School (Merced County) is well on its way to developing a complete digital high school. The teachers at Delhi will be pivotal in developing distance-learning applications and video-conferencing capabilities that will tie in the national laboratories and University of California consortia, with more rural and isolated schools and districts. The needs of the teachers at the various rural schools will drive the professional development in cross-curricular water education. This Central Valley region covers a broad range of people and businesses sociologically, economically, and technologically. This project will aim to bring closer parity in teacher preparedness in this area and heightened community awareness of water issues and local involvement.

Partners

- Edward Teller Education Center (ETEC)
- Tri-Valley Regional Occupational Program
- California State Water Resource Board
- LLNL Analytical and Nuclear Chemistry Division

Objectives

- Provide teacher training in utilization of Web-based GIS system.
- Provide training in support technology and make it available.
- Use teachers and administrators of grades 6-12, in planning and implementing professional development activities.
- Work with middle and high schools to enhance ongoing “Digital School” developments.
- Help establish distance learning and video conferencing capabilities.
- Integrate water related geographic information systems data and concepts into core subject areas: geography, history, English, science.

- Establish format for student/community input to GeoTracker for use by community.
- Provide Web-based and hands-on continuing professional networking for teachers and the community.

FY01 Accomplishments

- GAMA incorporated into a high school curriculum meeting the UC laboratory science requirements and the requirements for Advanced Placement science credit.
- Provided teacher training as a part of the Edward Teller Education Symposium.
- Developed a plan to provide students and parents in Merced County with technology education and career days beginning in FY2002.

Project Title: Math Challenge

URL: <http://step.llnl.gov/mc/>

This event, co-sponsored by STEP and the DOE Oakland Operations Office, is designed to encourage students' interest in math. It also seeks to support the goal of the 1989 Governors' Summit that U.S. students would be first in the world in science and mathematics. Each school participating in the Math Challenge may send up to five teams of three students to participate. Scores are added. Then the teams placing first, second, and third receive plaques honoring their achievement, while individual participants receive certificates of participation.

The 12th annual conference was held at LLNL in the summer of 2001. Fifty students and five LLNL employee volunteers participated in a series of math activities using puzzle solving as the basis of student learning.

Project Title: Science on Saturday (SOS)

URL: <http://step.llnl.gov/sos/>

Project Purpose

The purpose of the Science on Saturday program is to allow students to interact with well-known scientists and engineers. It also maintains a long-term goal of increasing the number of students who pursue careers in science and technology.

Project Description

Science on Saturday is a weekly series of free lectures and demonstrations intended for students, 6th grade through high school. The topics are selected from the forefront of science and technology research in a variety of disciplines. The topics selected from the research conducted at LLNL included:

Can you predict volcanic eruptions? – Radio Carbon Dating

Students learned how radiocarbon dating works to determine the ages of some very old materials. They explored how it has changed our view of history and the controversy that has arisen from its use. The program included an activity using M&M candy illustrating “half life,” a concept critical in understanding how radiocarbon dating works. The lecture ended by showcasing the Laboratory’s ability to radiocarbon date objects at the Center for Accelerator Mass Spectrometry (CAMS).

How do we know if our water is safe to drink? – Water Vulnerability Analysis

Students explored examples of the Alameda Creek watershed (Livermore Valley) and how surface water infiltrates the ground to become groundwater. They learned how scientists study the formation and movement of groundwater using age dating using radioactive decay of tritium (^3H , half-life = 12.4 yr.) to stable helium-3 (^3He) to accurately tell how long the water has been underground. By measuring groundwater ages, the students learned where and how fast the groundwater is moving. Areas of young groundwater (less than a few years old) locate zones that need the greatest protection from surface contamination.

Students learned that there are many types of careers involved in studying about our water resources. These careers included a mixture of geology, chemistry, biology, physics and engineering forms the backbone of the field.

What makes the wind blow? – Using computers to understand the atmosphere

Students were introduced to the forces that cause and affect the wind in the atmosphere. They explored the science behind why wind blows and how this knowledge is used at the National Atmospheric Release Advisory Center (NARAC) at LLNL to predict wind patterns and the paths of hazardous material released into the atmosphere. NARAC is always ready to warn people and to assess health consequences of hazardous releases.

What do your genes really do? – The Study of Protein Expression and Proteomics

Students explored one of the most exciting scientific discoveries of this or any century, the completion and consequences of the Human Genome project. With the publication of the sequence of the Human Genome, the scientific community has been propelled into a new era of post-genomic science. This is both an exciting and challenging advancement. The Human Genome project has forever changed the way that science is approached. The technological advances coupled with the vast amount of information that the Genome project has produced sets the stage for the examination of other areas of biology to be analyzed using a similar “Big Science” approach. Thus, several new fields of molecular and cellular biology have been born, including proteomics, the study of a complete complement of proteins, their interactions and functions within a cell or organism. Students learned how a scientist can use information obtained by the Genome Project to understand how a cell functions. They saw how scientists obtain information from genes to make proteins and how we can use these proteins in the laboratory. They learned about a variety of career opportunities in science and where the next scientific hot spots are to be found.

Can we predict if our climate is changing? – Global Climate Change

“Everyone talks about the weather, but no one can do anything about it.” This is fairly accurate for weather, but is it true for climate? Students learned that climate is not just past weather, but it is a long-term average of weather and weather patterns. The sun and the earth’s orbit seasonally influence both weather and climate; sunspots have an 11-year cycle. Other influences that have

long-term effects are: volcanic eruptions, changes in the distribution of sea-ice and snow, asteroids hitting the earth and increasing carbon dioxide (CO₂) from burning carbon based fuels. Molecules of CO₂ absorb energy much like a greenhouse traps heat from the sun. The more CO₂ in the atmosphere, the more warming occurs. CO₂ in the atmosphere has been increasing dramatically over the past 100 years and, unless the increase slows or stops, we can conclude that the earth will become warmer in the future.

How light is changing your future? – Optics Applications in Industry

Students learned how the optical revolution in communication is taking place, literally, right now, within their homes. Where only 200 years ago it once took weeks to transmit information in letters carried by foot, horse, or boat, the new transit of information takes place at the speed of light using lasers, propagating down shards of glass. This tremendous increase in the speed of information transfer takes place due to the merging of two sciences: optical physics and materials science understanding the nature of how light works and the discovery and perfection of glass fiber optics. They explored the developments in these two branches of science that have merged at this historical moment.



A student from the audience in a Science on Saturday lecture helps scientist Jim Ellis with a demonstration.

Partners

- Presentations are co-sponsored by STEP and the LLNL chapter of the Sigma Xi Research Society.

Objectives

- Provide students, teachers and the community with insights into current LLNL activities.
- Participants develop an awareness between the research topics and the science taught in the classroom.
- Teachers develop the background knowledge in science content to enhance their instruction.

FY01 Accomplishments

- Conducted six SOS workshops in FY01. Increased average participation rate from approximately 200 per session to 250 per session.

Project Title: Student Research Academy

URL: <http://step.llnl.gov/sra/>

Project Purpose

The purpose of the Student Research Academy is to prepare students to conduct self-guided research investigations.

Project Description

During this summer academy, students learn how to conduct a research study to answer a scientific question of their choosing. They participate in hands-on activities designed to develop their understanding of the research process. They explore a variety of research topics through discussions with LLNL researchers and tours to their laboratory settings. The students learn to use a science library to conduct background searches, and how to use software and computer technology to record and analyze research data. Students present their finished research findings at a symposium using research posters they develop and publish their findings in a student research journal.

Partners

- Sigma Xi, the Research Society
- Several LLNL Directorates including Biology and Biotechnology Research Program, Earth and Environmental Sciences.
- Edward Teller Education Center (ETEC)



Student Research Academy participants receive instruction in research methods.

Objectives

Students will be able to:

- Apply the research process to answer a research question of their choosing.
- Use computer technology to collect and record research data.
- Present their research findings in a symposium to peers, and research professionals in their field of study.
- Prepare a research paper discussing their findings.

FY01 Accomplishments

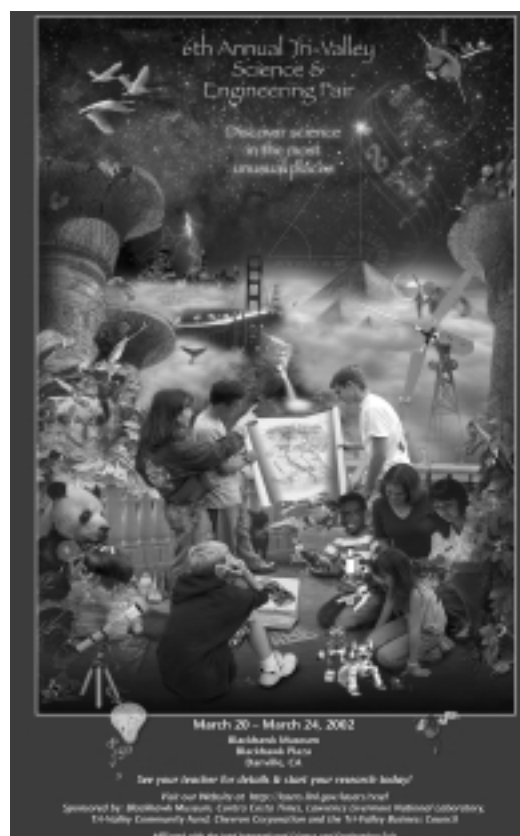
- Twelve students completed the Academy.
- Five of the SRA graduates submitted their research to the San Joaquin County Science Fair. They received five of the six top awards including a perfect score.
- Four of the graduates submitted their research to complete the research component of the International Baccalaureate Certificate.
- Three of the SRA graduates received internship from their researcher mentors at LLNL.

Tri-Valley Science and Engineering Fair (TVSEF)

URL: <http://lasers.llnl.gov/lasers/tvsef/>

The Tri-Valley Science and Engineering Fair is a science project competition for students, grades 7-12, from public schools within the areas of Danville, Dublin, Livermore, Pleasanton, San Ramon, and Sunol. The fair is affiliated with the Intel International Science and Engineering Fair. The STEP director has been the committee chair of the Fair's Science Review Board since its inception.

More than 250 students submitted projects to the 6th annual fair. The fair winners competed in the National Science Fair held in San Jose, California.



Promotional poster for the Tri-Valley Science and Engineering Fair

K-14 Educator Partnerships

Project Title: Computer Technology Workshops

URL: <http://step.llnl.gov/technology/>

Project Purpose

This program prepares teachers to effectively use the World Wide Web as a resource to improve the quality of their instruction and use their school's Web resources more effectively.

Project Description

Participants will be able to locate teaching resources online, provide students information about assignments, offer students support resources that carries teaching outside the

classroom, improve communication with parents, and enhance teacher-to-teacher collaboration.

Participants are able to register online for workshops of interest to them. Workshops are provided at various skill levels, from beginning to very experienced at using the Web to access teaching resources. The 10 workshop classes are divided into four areas:

- Computer System Workshops
- Accessing Web Resources Workshops
- Web Development Workshops
- Presentations Workshops

The Computer System Workshops prepare novice users to understanding the computer operating systems. They learn about the basic components of a computer, miscellaneous peripherals that may increase efficiencies, and related extensions and preferences. More advance courses prepare the more experienced user to troubleshoot problems and optimize their machines for best operating efficiency. The users in the advanced class learn to manage multiple Macintosh environments in their classroom. They explore security issues related to maintaining a Macintosh classroom, including updates on software and tools.

Accessing Web Resources Workshops are ideal for the Internet novice or anyone who feels uncomfortable using the Internet for curriculum support. Participants will better understand how the Internet works, resolve conflicts, how to get connected, and effectively configured and use a browser. This class will also examine some security concerns for classroom access and discuss trends for the Internet in education. A more advanced workshop is ideal for the educator who is comfortable using a Web browser but needs help focusing their Internet search. They learn to optimize their browser and use advanced searching techniques to reduce the time needed to find the information. This course will help educators to evaluate the validity of Internet resources and understand how copyright law applies to classroom use of the information found on the Internet. Participants receive resources to use in their classrooms and work on lesson plans that require student use of the Internet.

Web Development Workshops prepare teachers to publish information for others to use. Participants in this course will learn to use text editors, Microsoft Word, and HTML editors to create simple Web pages. An intermediate workshop prepares teachers to make Web pages that effectively communicate information to a targeted audience. They learn to modify images and add them to their Web pages, include page backgrounds, use tables to create elaborate layouts, create image maps, use anchors to improve navigation, add sound and movie clips to make the Web page interesting and useful. The advanced courses prepare teachers to create a database with a Web interface, using FileMaker Pro. Interactive pages allow the teacher to update the Web page by changing the database, such as current test results, and can allow users of the Web page to submit information (e.g., students submitting research information).

In other advanced workshops, participants learn to develop their own Web site. Participants examine several types of Web site architecture, practice using Web editors, and create a simple Web server. They will learn to use File Transfer Protocol (FTP) to publish Web pages remotely.

By the completion of the workshop, the participants will have experience using several software tools to publish information such as student grades, homework assignments, and curriculum support information.

Specialized workshops prepare teachers to use Adobe Photoshop to prepare images for use on their Web pages. They will explore basic concepts including changing views and image modes, selecting colors from palettes, creating custom colors, and manipulating graphics. Participants are encouraged to bring several pictures that they would like to modify and prepare for publishing on the Web.



Teachers learn to use the Internet as a tool to support their instruction.

Presentations Workshops prepare teachers to use PowerPoint to create dynamic presentations to enhance the quality of their teaching presentations. These presentations reduce the amount of time a teacher writes information on the black board, and create opportunities to integrate multimedia tools into the lecture capture the attention of all those that view it.

Participants learn using an “hands-on” teaching strategy. They spend most of their classroom time applying what they have learned to develop materials and resources they will use in their classrooms. They learn using Macintosh and PC computers giving them an opportunity to gain experience on the machines most readily available to them at school.

Partners:

- Edward Teller Education Center

Objectives

Participants will be able to:

- Learn to effectively use their computers as a tool to support their instruction
- More effectively use the schools web resources
- Locate teaching resources on-line,
- Build their own Web pages
- Develop multimedia presentations

FY01 Accomplishments

- During FY2001, 20 workshops were held between June and August. Each workshop could accept 15 teachers. An estimated 15 participants registered for each workshop.
- The computer laboratory equipment was updated to include a wireless network environment and 20 PC and 20 Macintosh laptop computers.

FY01 Accomplishments *continued*

- A new curriculum was written for implementation in 2002. This curriculum will establish a Web technology academy where teachers will learn to master several popular software applications ideal for creating and maintaining a Web site. All participants will apply these skills to build, publish, and maintain a Web site to support their instruction.
- Participants earn academic credit from the University of San Diego. Their work is evaluated for a letter grade as evidence of their skill development.

Project Title: Crystals for the Classroom

URL: <http://step.llnl.gov/crystals/>

Project Purpose

The purpose of this project is to improve high school and college chemistry teaching and student learning so that students will be drawn toward chemistry, rather than avoid it. The Crystals for the Classroom program maintains a student-centered, team-based learning strategy that embeds the principles of solution chemistry and analytical chemistry into a teaching-learning methodology representative of actual research.

Project Description

Through the Crystals for the Classroom project, students grow potassium dihydrogen phosphate (KDP) crystals using a “cutting-edge,” rapid-growth technology, similar to crystals grown for the laser optics of the LLNL National Ignition Facility (NIF).

The goal of the Crystals for the Classroom program is to help students learn basic chemistry principles, develop laboratory and critical-thinking skills through answering research questions and addressing goal-based challenges.

One of the LLNL consortium scientists, Dr. Natalia Zaitseva, developed a rapid-growth crystal technique while she was a professor in Russia in the late 1980s. She has been a key collaborator and adviser on the project.

The consortium scientists and science educators have demonstrated that this LLNL-developed, state-of-the-art crystal technology successfully transfers to high school classrooms.

The San Ramon Valley School District (SRVSD) has collaborated with LLNL scientists to initiate the Crystals in the Classroom project and has determined that students benefit from this technology. In 1999, SRVSD funded a high-school chemistry teacher to work in an LLNL research laboratory. She learned to use the rapid-growth KDP crystal technology and contributed to the design of a prototype classroom crystal-growing chamber. LLNL then donated the prototype crystallizer to SRVSD and mentored the teacher as she integrated this process into her high school and advanced placement chemistry curriculum.

During the 2000-2001 school year, high school chemistry students grew KDP crystals weighing approximately four pounds in five days. These students developed the chemistry skills and knowledge required by the California Chemistry Content Standards, for grades 9-12 for a number of basic chemistry concepts and topics, by growing KDP crystals. They gain an understanding of how chemistry contributes to the creation of new materials, to solve real-world problems. The content learned by the students included:

- Chemical, and physical properties of matter
- Conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants
- Solutions are homogenous mixtures of two or more substances, and
- Chemical equilibrium

Crystal-growth technology has much broader possibilities beyond the high school application. The Crystals in the Classroom project is being extended to community-college chemistry students. These students will use the original LLNL experimental crystal research data to develop an expandable and queriable database, to include the composition and concentrations of the starting solutions and the optical performance of the resulting crystals. Using this data, a plan for crystal growth using various doped starting solutions will be developed in concert with the high school students using the Internet.

The college students will test the starting solutions using Atomic Absorption Spectroscopy and wet-bench methods, and post the analytical results to the Web.

The high school students will grow the crystals and send samples to the colleges to test crystal performance using UV-visible absorption. This approach will allow students to analyze results from their own predictions and deduce the impact of changes in concentrations and growth protocols on crystal structure and optical performance within the context of an important national energy project. It is a multi-disciplinary project that involves mathematics, physics, chemistry, computing and engineering. In this way students will learn and apply research skills while conducting student-centered research. The LLNL- and student-research data will be made available for educational uses and the project will operate through a Web site developed and maintained by chemistry faculty at Diablo Valley College (DVC), Pleasant Hill, California, using a server supported by the LLNL Science and Technology Education Program.

To meet the goal of improving chemistry instruction, this project will disseminate the technology required to use these teaching tools through teacher professional-development workshops. The SRVSD and LLNL will provide training and mentoring to enable high school teachers to use this cutting-edge technology. Initially, the workshops will focus on schools and districts that are members of the Edward Teller Education Center (ETEC), an education collaborative serving the Livermore Tri-Valley and the San Joaquin Valley. STEP is a principle partner in ETEC along with the University of California, Davis, the University of California, Merced, and the UC Office of the President. In subsequent years, the training will be offered to schools throughout the United States. DVC and LLNL will operate a Web site and provide instruction, enabling students to access and use the queriable database.

This project has received special recognition for its contributions to science education.

Partners

A consortium of science educators and research scientists—including chemistry faculty from the San Ramon Unified School District, Diablo Valley College, Contra Costa College, and scientists from the Lawrence Livermore National Laboratory—came together with the aim of developing science and technology instructional tools for chemistry teaching. The project is supported and will be disseminated through the Edward Teller Education Center. The Dryfus Foundation is currently reviewing a proposal for funding to complete and disseminate the project.

Objectives

The goal of this project is to help students learn basic chemistry principles, develop laboratory and critical-thinking skills through answering research questions, and addressing goal-based challenges. It will accomplish this through the following objectives:

- Students will integrate technology into chemistry instruction. Students become proficient in high school chemistry and laboratory skills by growing crystals.
- Students will connect the basic concepts of chemistry to real-world applications, visualizing the relationship between classroom instruction and actual applications.
- Students will learn to use the research process. Students will apply research skills while conducting student-centered research projects. Students will make connections and explore complex issues requiring critical thinking.

FY01 Accomplishments

- Submitted a pre-proposal to the Dryfus Foundation.
- Submitted full proposal at the request of the Dryfus Foundation.
- Acquired data for the Web-based research project.

Project Title: Educational Partnerships

Educational Partnerships represents those activities where co-sponsorship includes at least one outside education institution, other than STEP. In most cases, these activities were either workshops or tours held at LLNL for educators, or workshops at educational institutions where STEP helped with presentations and/or presentation materials.

For example, STEP highlighted its education activities and the Lab's research into a significant partnership event, the Educator Day at LLNL. It was presented collaboratively with Merced College in June 2001. Approximately 100 education administrators and several California legislators representing the San Joaquin Valley attended this event. They received an overview of LLNL and the educational resources available for teacher professional development, as well as student enrichment activities at LLNL. The participants toured four research facilities: CAMS, Optics Labs, ARAC and, the new University of California education-outreach collaboration, the Edward Teller Education Center (ETEC).

As a result of this event, LLNL and ETEC were asked to present a similar program to educators and California legislators attending the annual California Rural Education Summit.

Project Title: Edward Teller Science and Technology Education Symposium

URL: <http://step.llnl.gov/symposium2001/>

Project Purpose

The purpose of the Edward Teller Science and Technology Symposium is to provide teachers with teaching resources that help them keep their instruction current.

Project Description

Researchers at the Lawrence Livermore National Laboratory share cutting-edge science and technology with secondary and community college science educators. Participants receive state-of-the-art science information, take-home lessons, and activities to be used in the classroom. The lessons and activities are directly linked to the California Science Education Standards.

Examples of activities presented at previous symposia are available on the STEP Web site, <http://step.llnl.gov/symposium2001/>.

The Edward Teller Science and Technology Symposium provides a bridge between the science classroom and the research laboratory. Science educators from secondary schools and community colleges have the opportunity to explore ongoing research at LLNL.

One hundred twenty science educators from schools and colleges throughout California participated in the Symposium in FY01. Each participant was assigned to one of the four content groups based on their teaching interest: physics, chemistry, biology or environmental science. Within each of these content themes, LLNL research sites were selected to be the focus of the symposium.

During the symposium, the participants toured state-of-the-art research laboratories related to their interest, where they talked with researchers about their work, listened to address by Dr. Edward Teller, and enjoyed a “Dinner with a Scientist” event. During the dinner event, they learned about current science and technology applications from a nationally-recognized keynote speaker.

Each participant attended three “hands-on” workshops to learn new activities to be used in the classroom. Lessons and activities included:

Biology focused on biotechnology

This group explored various processes of recombinant gene expression and protein purification. Participants isolated Green Fluorescent Protein (GFP) using the Bio-Rad Biotechnology Explorer purification kit.

Environmental science focused on radiocarbon dating

Participants learned the basics of radiocarbon dating in a lecture setting and where it fits into the California Science Standards. They participated in problem-solving activities where they interpreted actual ^{14}C data sets from volcanic eruptions and earthquake faults to determine the dates of the activities. Supporting documents were provided so that all of the activities could be used immediately in the classroom.

Chemistry focused on groundwater monitoring

Using age dating, participants learned how connected groundwater is with the surface of the earth. Because of this, they learned how vulnerable the groundwater may be to contamination. Participants carried out a hands-on exercise using data from the Alameda Creek watershed (Livermore Valley) and saw how surface water infiltrates the ground to become groundwater.

The formation and movement of groundwater is tracked using age dating. The radioactive decay of tritium (^3H , half-life = 12.4 yr.) to stable helium-3 (^3He) can be used to accurately tell how long the water has been underground. Areas of young groundwater (less than a few years old) identify zones that need the greatest protection from surface contamination.

Physics focused on opto-electronic technology

Participants learned how developments in materials and optics—two branches of science—have merged at this historical moment, to create the optical revolution in communication. Where only 200 years ago, it took weeks to transmit information in letters carried by foot, horse or boat, the new transit of information takes place at the speed of light, using lasers propagating down shards of glass. This tremendous increase in the speed of information transfer takes place due to the merging of two sciences: optical physics and materials science. This includes understanding the nature of how light works and the discovery and perfection of glass fiber optics. Participants completed hands-on exercises in polarization, built polariscopes, and applied their knowledge to understand how liquid crystals are used in communication.

Each participant was given a set of materials to use in the classroom. The set contained explanations about the activities and slides actually used in the workshops. A CD-ROM, with images of the tours of the laboratory facilities and all of the materials used in the workshop, was also distributed.

Partners

- Edward Teller Education Center
- University of California-Davis, Department of Applied Science,
- The Sigma Xi Research Society

Objectives

Participants will:

- Gain new content knowledge.

- Learn to use new lessons to explain this new content information
- Add scientists and science teachers to their network of resources
- Experience how science is applied to solve problems.

FY01 Accomplishments

- 120 secondary-education and college faculty registered and attended the symposium.
- Quality of the materials was enhanced. This provided each participant with the same set of materials used in the workshop, including color transparencies to use in the classroom. Each participant also received a CD-ROM, containing all the materials used in the four content themes.

Project Title: Great Explorations in Math and Science (GEMS)

Great Explorations in Math and Science units from Lawrence Hall of Science are elements of three STEP science education activities:

- Fun With Science
- PATHS
- Science on Saturday

While scientists presented lectures to the public through the Science on Saturday series, STEP offered science-curriculum unit workshops to 4th-8th grade teachers. After the teachers attended the lectures, they remained to be trained in GEMS units, which correlate to the Science on Saturday topics.

Teachers were trained on GEMS units and were provide hands-on science curriculum for their students. The materials provided teaching strategies and investigations to further explore the science content presented in the Science on Saturday series.

Scientists who spoke during the Science on Saturday lectures visited with the teachers after the lectures, to answer questions and provide additional scientific background information.

Teachers appreciated the personal contact with the Laboratory scientists. Resources and support were provided through a collaborative effort with the San Joaquin County Office of Education.

Participants were given the teacher guide to the GEMS unit and materials to teach the unit with their students.

Those teachers attending four of the Science on Saturday Lecture Series could apply for college-course credits through Fresno Pacific College. Eighteen teachers participated in the GEMS training at each of the four sessions.



A teacher in a biotechnology workshop consults with the instructor, Kirk Brown

Project Title: Laser Science and Optics in the Classroom (LSOC)

URL: <http://step.llnl.gov/LSOC/>

Project Purpose

The LSOC purpose is to introduce optics as a resource to support existing instruction across science disciplines in mathematics.

Project Description

The Laser Science and Optics in the Classroom program is a high school component initializing a school-to-career path leading to careers in laser science and optics. Teachers participating in LSOC receive materials and lessons to help them integrate laser and optics technology into high school science and mathematics curricula. LSOC lessons are activity based, giving students hands-on experience using lasers and optics equipment. Professional development workshops were conducted with teachers in from schools through the Silicon Valley and San Diego areas as a part of the Optical Society of America and International Society for Optical Engineering conferences. These teachers were introduced optics into their existing curriculum where it matches the state science standard requirements.

Partners

- Edward Teller Education Center
- Optical Society of America
- International Society for Optical Engineering
- LaserLight Lab, Inc.
- Tri-Valley Regional Occupational Program

Objectives

Participants will:

- Learn how a laser functions.
- Conduct experiments and optics activities using the equipment in the LSOC kit of materials and equipment.
- Be able to integrate optics into existing instruction across science disciplines and in mathematics.

FY01 Accomplishments

- During FY2001, 60 teachers attended the International Society for Optical Engineering and Optical Society of America conferences participating in LSOC workshops.
- The LSOC materials were used in a high school curriculum offered in the Livermore Tri-Valley area.

Project Title: Promoting Achievement Through Hands-On Science (PATHS)

Through a partnership of LLNL, the University of California, Merced, and the San Joaquin County Office of Education, the PATHS program provides a science-education outreach program to schools in the Livermore area and Central Valley counties.

PATHS brings the LLNL “Fun With Science” program to schools. Students interact with scientists while experiencing hands-on science demonstrations in chemistry, physics, and environmental science. This then increases students’ learning achievement and science awareness. Students are engaged, excited, and involved in science education activities.

Following the presentation to students, teachers are trained on a “Great Explorations in Math and Science” (GEMS) unit from Lawrence Hall of Science, as selected by the school and aligned with the Fun With Science presentation and the California State Science Standards. Schools are provided with the science kit and all materials needed to teach the unit in their classrooms. Teachers are encouraged and prepared to teach quality, hands-on, inquiry based science units while training at their school site.

FY01 Accomplishments

- Liselle Clark, a visiting educator in STEP, provided after-school training in 15 schools to over 100 teachers.
- Fifteen schools, 100 teachers, and over 2,200 students in grades K–8th were directly impacted by the PATHS Program.

Project Title: UC/Community College/ Central Valley Education

Project Purpose

The purpose of the UC/Community College/Central Valley Education program is to support and promote student achievement in science and math education in the Central Valley through collaborative efforts with the University of California, Merced, and Merced College.

Project Description

STEP prepared a Memoranda of Agreement (MOA) linking UC Merced and Merced College with LLNL to share the science and technical resources and promote student achievement in science and technology. Several activities were carried out during the year to implement this MOA.

Educators and state legislative representatives from throughout the San Joaquin Valley participate in Educator Day at LLNL. During this day, the participants attend presentations that highlight current and potential resources at LLNL, which are available to support science instruction. They

visit several research laboratories to experience the “real science” from which these education resources are developed.

Merced College has begun sending faculty to LLNL for sabbaticals. The initial faculty worked in the biomedical program participating in biotechnology research. They used this experience as background instruction to assist them in implementing a new biotechnology technician certificate program at Merced College.

STEP established a scientific equipment loan program with Merced College. This equipment will be used to develop programs to train students in optics, biotechnology, environmental science, and computer science technician programs.

Partners

- Edward Teller Education Center (ETEC)
- UC Merced
- Merced College

Objectives

- Increase student performance in science and technology education.
- Provide professional development for all K-12 teachers throughout their teaching careers.

FY01 Accomplishments

- 120 educators and state legislative representatives participated in the LLNL Educator Day.
- Faculty from Merced College completed sabbaticals at LLNL in biomedical research.
- STEP collaborated with Merced College to present an Educator Day at LLNL.
- Developed a plan to provide students and parents in Merced County with technology education and career days beginning in FY2002.
- Participated in the Rural Education Summit as an invited guest of Merced College.
- Merced College conducted feedback evaluations of the Educator Day and the faculty sabbaticals.

Edward Teller Education Center (ETEC)

URL: <http://etec.ucdavis.edu/>

Purpose

The Edward Teller Education Center provides science and technology professional development programs for K-14 teachers and enrichment activities for students.

Description

ETEC is an education consortium, sponsored by the University of California Office of the President, operates in collaboration with the University of California, Merced, the University of California, Davis, and Lawrence Livermore National Laboratory. ETEC provides professional development opportunities for teachers and enrichment opportunities for students in science and technology. The UCOP Education Outreach office has provided initial funding for ETEC.

The ETEC consortium provides a comprehensive approach to ongoing training for teaching professionals and enrichment programs for students. Its aim is to provide all teachers with development opportunities that promote continued growth and renewal, and to promote student preparation for science careers. The initial focus of the consortium is on science and technology, a natural outgrowth of the unique set resources and expertise existing at UC Davis Department of Applied Science and LLNL.

ETEC is managed by principal investigators from UC Davis and UC Merced. A Board of Directors—representing districts, county offices of education, colleges and LLNL—provide direction to the operation of ETEC. The board ensures that the focus of the programs offered will provide developmental opportunities to consistent with the needs of the teachers and students.

ETEC will use facilities of the UC Davis Department of Applied Science, and the “world-class” resources of LLNL to support the science and technology programs offered. This support will include conducting the LLNL Science and Technology Education Program instruction at ETEC.

During this initial year of operation, STEP conducted several professional development programs at ETEC. These programs included:

- The Edward Teller Science and Technology Education Symposium
- Computer Technology Instruction for teachers
- The Student Research Academy
- The California State Summer School for Mathematics and Science (COSMOS)

ETEC will receive two new classrooms, which will include a wet laboratory and a multipurpose classroom. STEP has designated a computer laboratory for the teacher and student programs at ETEC. This laboratory will be upgraded to a wireless network and offer new, state-of-the-art laptop computers. LLNL is loaning a professional optics laboratory at ETEC for educational use. This laboratory was initially established to support the laser electro-optics technician program, offered through Las Positas College. It will continue to be used by Las Positas Collage; however, the laboratory will also be available for other optics instruction.

In November 2001, LLNL, UC Merced, UC Davis and the UCOP held a groundbreaking ceremony for the construction of the new modular facility for the Edward Teller Education Center. The new building is expected to be completed in April 2002.

Partners

The ETEC establishes a collaborative partnership with the school districts in the supported communities, and is managed by UC Davis Department of Applied Science. This partnership incorporates the support and participation of three additional UC campuses: the Lawrence Livermore National Laboratory, UC Merced, and the Lawrence Hall of Science. UC Davis, in collaboration with UC Merced and the Lawrence Livermore National Laboratory, was funded on February 2, 2001, by the UC Office of the President to establish the Edward Teller Education Center. In addition to its UC and LLNL partners, ETEC currently consists of the following school districts, colleges, and county offices of education:

- Castro Valley Unified School District
- Clovis Unified School District
- Colinga-Huron Unified School District
- Denair Unified School District
- Kern County School District
- Las Positas College
- Livermore Joint Unified School District
- Merced College
- Merced County Office of Education
- Merced Union High School District
- San Joaquin County Office of Education
- Stockton Unified School District

Objectives

- The Edward Teller Education Center is to improve the quality of instruction in science and its applications in technology, by providing professional development opportunities for K-14 teachers. Specifically, these opportunities will be targeted to integrate and support the California subject matter standards and teachers needs as identified by teachers, school districts, and county offices of education.
- The goal of this project is to provide students, teachers, and the community with insights into current LLNL activities. It is anticipated that participants will develop an awareness between the research topics and the science taught in the classroom. Teachers are expected to develop background knowledge in science content to enhance their instruction.

FY01 Accomplishments

March 2000	MOU between LLNL and UC Davis to share resources to jointly conduct education outreach activities at the UC Davis Department of Applied Science
June 2000	STEP begins conducting teacher development instruction in Computer Internet Technology at DAS



Edward Teller turns over the first shovel of dirt during the groundbreaking ceremony for ETEC (November 2001).

FY01 Accomplishments *continued*

July 2000	UC DAS and LLNL STEP begins working collaboratively with the UCOP to establish a professional development center for K-12 teachers.
Aug. 2000	UC Merced funds from San Joaquin County of Education a “teacher in residence” at LLNL to support teacher workshops
Oct. 2000	Bruce Tarter, LLNL director, signs an MOA between UC Merced, Merced College and LLNL to support education activities.
Oct. 2000	Rick Freeman, Chair of DAS, submits a pre-proposal to Bob Polkinghorn, UCOP Asst. VP for Educational Outreach, requesting funding to operate a regional professional development center located at the DAS Livermore campus.
Jan. 2001	UCOP provides operating funds to ETEC for its first year
Feb. 2001	LLNL transfers UC DRD funds to UC Davis for the installation of a modular facility to provide classroom space for the ETEC.
March 2001	Edward Teller lends his name to the center calling it the Edward Teller Education Center.
June-Aug. 2001	ETEC co-sponsors a subset STEP education-outreach activities for teachers and students (20 students and 300 teachers).
Sept. 2001	ETEC and UC Davis DAS, and LLNL co-sponsor the Edward Teller Science and Technology Education Symposium; 120 high school and community college teachers throughout California attend.
Nov. 2001	Groundbreaking ceremony is held for the construction of the new modular facility for ETEC
March 2002	Expected completion date for the construction project (a modular high-school science room with both wet lab and computer lab capabilities)

Section 4 – LLNL Institutional Education Activities

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Introduction

STEP continues to take the lead in facilitating and piloting numerous educational initiatives at Lawrence Livermore National Laboratory. STEP leads the LLNL Institutional Education Committee (IEC) to combine efforts throughout the Lab to promote student activities. This includes providing updates about LLNL opportunities for students and faculty through an LLNL education-dedicated Web site (<http://www.llnl.gov/education>).

This is also the second year STEP has acquired a site license for the GRE PowerPrep and engaged Kaplan Associates, to help students prepare for the Graduate Record Exams.

Working with the IEC, STEP offers all summer participants a schedule of seminars and tours, social activities, and a series of panel discussions. In addition, STEP provides a mechanism by which summer students can network, through an online Student Bulletin Board (SBB) (<http://step.llnl.gov/sbb/>). The bulletin board gives students the opportunity to interact on a social level, and learn about scheduled lectures, seminars, and social activities. Students can also access information on events and activities in the Bay Area region and beyond.

Using the Student Bulletin Board, interns can network with the other registered summer students through a list server, can arrange their own meetings, seek input from their peers, will receive the latest update on seminars that interest them, and will be notified of any last minute seminar times and locations.

Through the Student Bulletin Board, students can even access information about scholarships. A link is provided to the 2001 Colleges, College Scholarships, and Financial Aid Web site, <http://www.college-scholarships.com/>.

The FY01 summer students offered positive feedback about the bulletin board (“I think the bulletin board is great. Can’t think of any changes.”) and suggestions to improve links or organization of the site. Generally speaking, students find the bulletin board useful for checking on the status of events and to registering online for tours and other events.

Is an Undergraduate Education Sufficient?

As in its pilot year, FY00, a number of activities were offered in FY01 to motivate students to pursue graduate degrees. This included offering free downloads of the GRE PowerPrep software (a site license acquired by STEP), and a GRE Pretest and feedback strategy session, sponsored by Kaplan Associates.

The GRE is a computer-based exam and, as a result, a student cannot skip and return to previous questions. When taking the exam, a student must answer the questions sequentially. If questions are answered correctly by the student, the programmed test offers harder questions. If questions

are answered incorrectly, the student is asked easier questions. Through this process, a student's knowledge is qualified to a set number.

Taking the GRE requires a different strategy, which Kaplan Associates addresses. Students who participated in the feedback session felt the opportunity was a very useful and informative, helping them prepare for the exam.

Some students questioned why the exam was scheduled after an eight-hour workday. STEP is now considering offering the exam on Saturday. Other students, who chose to download the GRE PowerPrep software and self-assessment test, agreed this was an excellent resource.

If the students take the self-assessment early in the summer, they can then identify resources within the Lab to help strengthen their knowledge base.

In an effort to dispel the many myths and misunderstandings about applying to and getting accepted to graduate school, Dr. Collette Patt, director of the Physical Sciences Student Diversity Programs at the University California, Berkeley, made a presentation to the summer students. This is the second year Dr. Patt has spoken at LLNL about graduate school admissions. A number of students agreed that the information provided about the graduate school process was extremely useful. In fact, one Native American female decided to pursue graduate school, based on Dr. Patt's presentation, dispelling the myths about applying to and funding graduate school.

LLNL Institutional Education Committee (IEC)

Lab employees, involved in facilitating hands-on experiences for students, have pooled their limited and constrained resources to participate in a Lab-wide committee—the LLNL Institutional Education Committee—facilitated by STEP personnel. Recent participant organizations have included:

- Affirmative Action and Diversity Program
- Biology and Biotechnology Program
- Energy Directorate
- Engineering Directorate
- Environmental Protection Department
- Environmental Restoration Division
- Geophysics & Global Security
- Health & Ecological Assessment
- Human Resources
- Materials Research Institute
- Operations and Regulatory Affairs Division
- Science and Technology Education Program
- University Relations Program

Members of the IEC have provided input for the development of the electronic student bulletin board and have facilitated various seminars, tours, brown bag lunches, socials, and panel discussions, as described previously.

Each summer, LLNL hosts approximately 300 to 400 students who support research projects. These students range from the exceptional high school student to undergraduate and graduate

students. With this variety in age, disciplines, academic background, etc., the committee has recognized that a broad program is needed to address the diversity of student interests. The IEC has pooled its resources to provide such a program.

A research experience is highly valuable to the Laboratory and the students; however, if students feel isolated, it can still be a poor experience for the students.

STEP has received supportive comments from students such as, “I love working at LLNL! I would highly recommend it to anyone interested in research.” and “I had a great experience, and look forward to working with everyone next summer!”

In addition to providing institutional support to students, STEP has made efforts to address the needs of a future LLNL work force, with identified critical skills, and to build a pipeline of support for LLNL recruitment efforts. This support has resulted in requests for STEP personnel to serve on Laboratory subcommittees. One result of this collaborative work is that the STEP Web site promotes and links to the LLNL “Scholars Employment Program” Web site, developed by the LLNL Human Resources Department. STEP has also helped prepare an orientation for the supervisors of summer students.

Student Bulletin Board

The Student Bulletin Board (<http://step.llnl.gov/sbb/>) offers lists of activities and lectures, specifically for students, and provides information about scholarships and grants. It is also a venue for participants to network with each other or plan weekend activities.

In FY01, there were 26 scheduled events (meetings, seminars, tours, etc.) within the following major elements:

- Two GRE practice tests and feedback session
- Two classes on how to create effective poster presentations for the lab-wide student symposium
- LLNL student research poster symposium
- Three part session titled, “Research: Methods, Manuscripts, and Money”
- BBQ
- Ice cream social
- Exploring the advantages of using protons instead of x-rays as radiographic probe to study the performance and aging of weapons seminar
- Fast-growth crystal seminar
- Geysers geothermal project seminar
- Graduate admittance myths & discussions discussion
- National Ignition Facility seminar and tour
- Smart probe seminar
- Technology advances seminar
- Uncovering bio-terrorism seminar
- ASCI White seminar and tour
- Exploring environmental and biomedical sciences with the Accelerator Mass Spectrometry (CAMS)

When asked which seminars/tours were preferred, nine out of 10 students responded with “the

National Ignition Facility (NIF).” One student said, “NIF – it is incredibly huge!” Second to NIF, other popular tours included the Accelerated Strategic Computing Initiative and Center for Accelerator Mass Spectrometry. When students were asked what seminars/tours should be discontinued, the majority said “anything that happens at the Lab is interesting.” A series of presentations called “Research: Methods, Manuscripts, and Money” was especially well received. One participant stated, “Excellent. This is the real deal. Stuff that will give LLNL interns a competitive advantage.”

When asked to describe networking accomplished, one student responded, “Going to panel discussions, lecturers, and picnics were great opportunities for networking. I met other students, other Lab workers, and people from other agencies. Meeting other lab students provided social opportunities. Lab workers branched out so that I was able to meet other Lab workers who were related to my major and helped me meet other people or introduced me to numerous resources (Web sites, scholarships, professors . . . to help me with graduate school and career decisions. Through the panels, I met Dr. Gary Ellis, who has a great job that I wouldn’t mind having one day. I obtained his business card and have been in contact with him. All of these people are just a wealth of information and have been more than helpful during my stay at LLNL.” Another student said, “I have gained contact with several professors with experience using equipment we purchased for the project, one of whom has expressed interest in helping me develop my project into a master’s thesis.”

School-to-Career Panel Discussions

For the second consecutive, the Laboratory has held panel discussions. This year, a series of three discussions was offered with a theme of “School to Career.”

Panel topics and titles are as follows:

Panel: Graduate Opportunities – Advanced Education/Fellowships

Panel members from various Lab fellowship programs participated:

- Glenn Fox, moderator and manager of the Chemistry and Material Science Postdoctoral Program and member of the Lawrence Committee
- Charlie Westbrook, Student Employee Graduate Research Fellowship Program
- Gene Bailey, National Physical Science Consortium
- Carla Trujillo, director of Diversity Programs, College of Engineering, UC Berkeley
- Alan Wootton, LLNL Postdoctoral Program
- John Knezovich, University Relations Program Institutes and Centers

Comments: “Great panel. Made me realize that I must attend graduate school in order to further my career.” and “This was very helpful for those of us thinking of advanced education.”

Panel: Young Researchers – New Careers, New Challenges

- Jean Shuler, moderator and program leader for Accelerated Strategic Computing Initiative



Third in a series of summer panel discussions addressing the theme of “School to Career.” This panel: Science Policy, Funding, and Ethics included Ron Cochran (LLNL), Gary Ellis (National Science and Technology Council) and Martha Krebs (California Nano Systems Institute).

- Joanna Albala, recipient of the 2002 New Investigator Award
- Tina Back, recipient of the 2000 LLNL Defense Nuclear Sciences and Laser Directorate Award
- Pat Bresenhand, co-founder of the University of California San Francisco Postdoctoral Association
- Christine Hartman-Siantar, recipient of the 2000 LLNL Edward Teller Fellowship
- Alfredo Morales, recipient of the 1999 Sandia Employee Recognition Award for Technical Excellence

Comments: “I enjoyed this panel and the perspective the younger scientists have. It was good to hear their different stories of how they have come to where they are now and the advice they gave.”

Panel: Science Policy, Funding, and Ethics

- Kathy Cromwell, moderator and LLNL congressional liaison
- Ron Cochran, LLNL executive officer
- * Gary Ellis, executive secretary, National Science and Technology Council
- Martha Krebs, Director, California NanoSystems Institute (past director, DOE Office of Science)

Comments: “I enjoyed this panel the most as I got to meet some of the people who help make the policy and rules we must all follow. It was good to see they were all so conscious of the concerns of most people.”

When asked whether panel discussions should continue in future summers, the response has been overwhelmingly positive. Comments included, “The panels should definitely be repeated with an engineering focus.” and “The presenters did a good job with their introductions and the moderators did a good job as well.”

Videos of all the panelist discussions have been made and are available for loan through STEP.

Students-On-The-Go (activities proposed by students)

The Students-On-The-Go feature is one of the most popular sections of the Student Bulletin Board. Students and faculty posted numerous evening and weekend social and recreational activities, for example:

- Ultimate Frisbee (any skill level)
- Windsurfing and water sports at Del Valle Regional Park
- Death Valley on Labor Day
- Volleyball every day at noon
- Huge BBQ - Fun Times
- Giants Tickets
- Giants vs. Athletics Game Saturday
- The Goodtimes BBQ for everyone
- \$1 Bowling Mondays, Tuesdays, Wednesdays
- Whitewater kayaking
- SF Pride Parade
- Phil Lesh and Friends or Tre Anastasio Sol Tour
- Tchaikovsky Showcase
- Weekly Mountain Bike Rides

Although some students acknowledged they didn't take full advantage of all the activities and networking made available through STEP, most agreed the activities were very helpful to them. Students felt encouraged to participate in social activities outside of work, to enhance their summer experience, to minimize feelings of isolation, and to get acquainted with other summer students.



Summer BBQ, where Dr. Kenneth Washington, Director of Sandia National Laboratories Livermore Distributed Information Systems Center, spoke on “The 21st Century and High Performance Computing”—an interesting presentation drawing and numerous comparisons of today’s technological capabilities to Star Trek technology.

Roommate Matching

An online student roommate matching service, first offered in FY00, was temporarily disabled in FY01. Additional computer security measures are being implemented to protect the personal information provided by the students. The intent of the service is to help future summer students identify potential roommates and reduce the expenses for shared lodging.

Student News List

This mailing list is open to students and faculty participating in the summer programs, internships, and other activities at LLNL. Subscribers are encouraged to use the list to network while at the Laboratory and to update their e-mail addresses when they leave. Announcements and other information of interest to visiting students are posted on this list. More than 197 participants are currently registered.

Students have indicated that the mailing list is a good way to communicate with other students, receive new program information, and learn about upcoming seminars.

Appendices

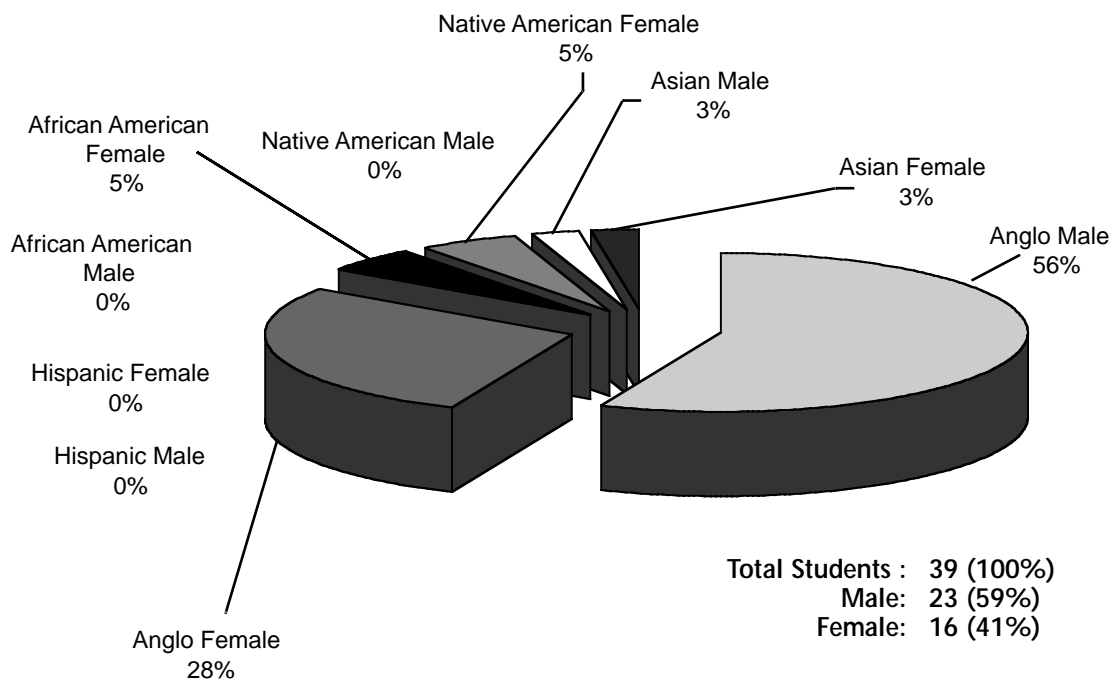
Appendix 1 – Demographic Data on Select Participants

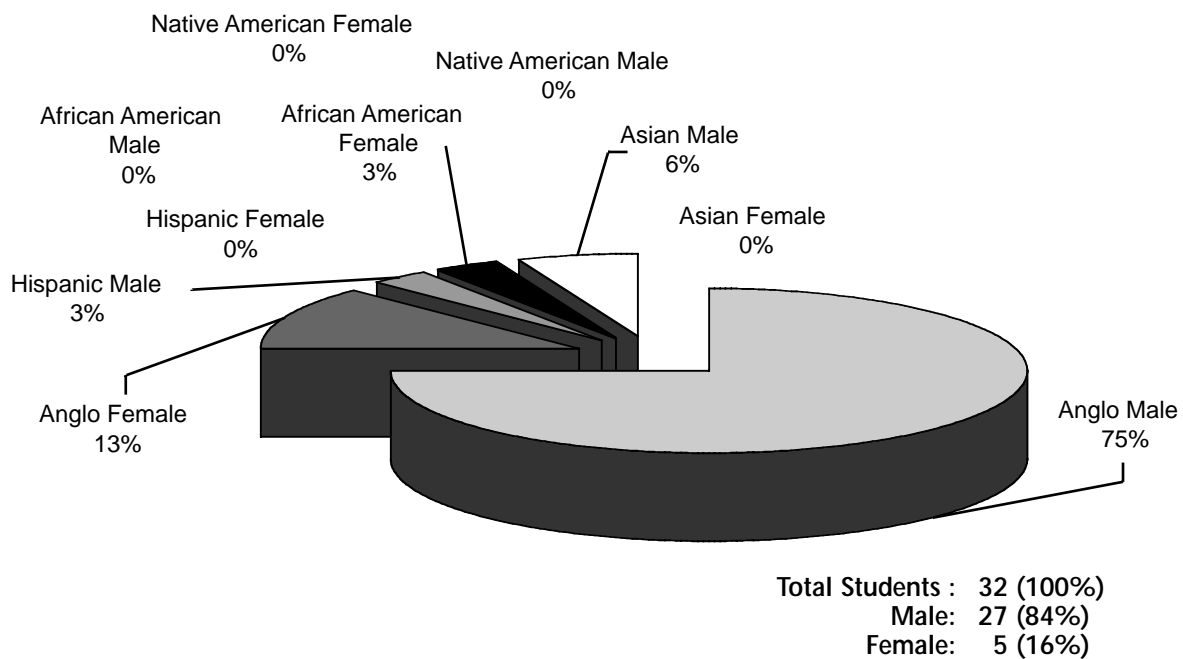
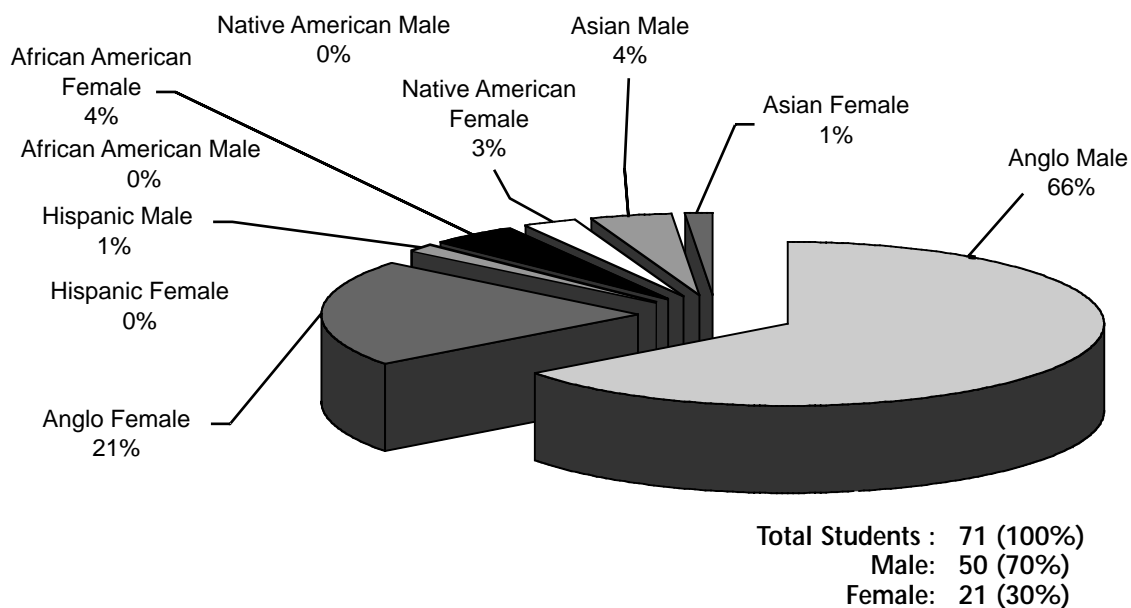
STEP collects demographic data for the LLNL internship projects funded by NNSA-DP Office of University Partnerships. (See Section 1, Project Accomplishments.)

NNSA-DP-OUP Projects	College Student Interns
Accelerated Strategic Computing Initiative (ASCI) Pipeline	12
Actinide Sciences Summer School	6
Interns for Defense Technologies	20
Internships in Terascale Simulation Technology	27
System Administration Computer Support	6
Total	71

With respect to the 71 interns who worked to carry out research within the Lab's Stockpile Stewardship Programs, the following four charts provide demographic data on gender and ethnicity for the 39 undergraduate participants and 32 graduate participants, respectively:

Undergraduate Participants



Graduate Participants**Total Participants**

Appendix 2 – Lecture Series and Workshops

In support of student internships, STEP plays a major role in helping define, organize, and sometimes lead many of LLNL activities to meet the Laboratory's broad education goals. In addition to their research experiences, STEP makes available to student interns a number of lectures and seminars to help them further their studies and their career goals. These events are all based on the Laboratory's mission-oriented sciences.

Below are the instructional events offered to students working DP critical issue program for FY01:

Accelerated Strategic Computing Initiative (ASCI) Pipeline Lecture Series

URL: http://step.llnl.gov/asci_interns/schedule.html

Session 1: Introduction to Parallel Computing

Session 2: Introduction to Livermore Computing Resources

Session 3: Using LC's Compaq Clusters

Session 4: Using the ASCI IBM SP System

Session 5: Message passing Interface (MPQ)

Session 6: POSIX Threads

Session 7: Open MP

Session 8: Total View Debugger

Actinide Science Summer School Program (ASSSP) Lecture Series

URL: <http://step.llnl.gov/asp/>

Speaker: Prof. Heino Nitsche, University of California, Berkeley/LBNL
Actinides and the Environment: A Challenge for Interdisciplinary Research

Speaker: Prof. Darleane Hoffman, University of California, Berkeley/LBNL
Nuclear Chemistry of the Heaviest Elements: One Atom-at-a-Time

Speaker: Dr. Kenton Moody, Lawrence Livermore National Laboratory
Nuclear Forensics

Internships in Terascale Simulation Technology (ITST) Tutorial Lecture Series

URL: http://step.llnl.gov/itst/itst_schedule.html

- Speaker: Dr. Omar Ghattas
Dynamic Meshes, Dynamic Interfaces, and Hemodynamics
- Speaker: John May, SCCD,
Parallel I/O
- Speaker: David Brown, SCCD
The OVERTURE Framework for Representation of Complete Geometries
- Speaker: Gary Kumfert, SCCD
Selling Research and the Researcher
- Speaker: Charles Peskin
Computer Simulation of the Heart
- Speaker: David Keyes, CASC
Stresspoints for High Performance in Parallel PDE Solvers
- Speaker: Van Henson, SCCD
Krylov Space: an introduction to the Conjugate Gradient Method and its
Friends for People with a Really Low Threshold of Pain
- Speaker: Woodward/Critchlow
Tips for a Successful Interview
- Speaker: McKee
High performance computing
- Speaker: Garcia
Introduction to Particle Methods

Military Academic Research Associates (MARA) Briefings

URL: http://step.llnl.gov/mara/MARA_schedule.html

- Speaker: George Sakaldasis
National Security Overview
- Speaker: Lt. Col. LeAnn Brasure
Air Force Research Laboratory
- Speaker and Tour: Jim Ellis and Ron Basket
Atmosphere Release Advisory Capability
- Speaker: Fred Milanovich
Biological Weapons Overview

Speaker and Tour: Craig Wuest, Mike Tobin
National Ignition Facility

Documentary: Explosive Situations

Speaker and Tour: Bill Gilliam
High Explosives Application Facility

Speaker: Milt Finger
DoD Technologies

Speaker: Bill Bookless
An Overview of Stockpile Stewardship

Speaker: Lt. Col. Wayne Brasure
DTRA Stockpile Stewardship Overview

Speaker: Ron Lehman
Global Research Overview

Speaker: Mike Uzelac
JTOPS/Conflict Simulation Lab

Speaker: Tom Ramos
Counterproliferation and Analysis Program Briefing

Tour: Larry Sedlack
Site 300

Summer Student Seminars/Panels/Tours/Socials

URL: <http://education-db.llnl.gov/sbb/>

Event: Brown Bag Lunch with Dr. Edward

Event: GRE Practice Test and Feedback Session

Event: How to Create Effective Poster Presentations

Event: LLNL Student Research Poster Symposium

Event: Allen Grayson, Bill Hoppes, and Chris Campbell

Research: Methods, Manuscripts, and Money

Social: BBQ

Social: Ice Cream Social

- Speaker: Ed Hartouni
“Exploring the advantages of using protons instead of x-rays as radiographic probe to study the performance and aging of weapons”
- Speaker: Ruth Hawley-Fedder
Fast-Growth Crystal
- Speaker: Larry Hutchings
Geysers Geothermal Project
- Speaker: Colette Patt, University of California, Physical Sciences Student Diversity Programs, Dean’s Office – Letters and Sciences
Graduate Admittance Myths and Discussions
- Speaker: Ed Moses
National Ignition Facility
- Speaker: John Marion
Smart Probe
- Speaker: Dr. Kenneth Washington
Technology Advances
- Speaker: Paula McCready
Uncovering Bioterrorism-DNA-based signatures are needed to quickly and accurately identify biological warfare agents and their makers
- Tour: ASCI White/David Nowak
- Tour: John Knezovich
Exploring Environmental and Biomedical Sciences With a Powerful Analytical Technique: Accelerator Mass Spectrometry
- Tour: National Ignition Facility
- Panel: **Graduate Opportunities - Advanced Education/Fellowships**
Glenn Fox, moderator and manager of the Chemistry & Material Science Post-Doctoral Program
Charlie Westbrook, SEGRF
Gene Bailey, National Physical Science Consortium
Carla Trujillo
Alan Wootton, LLNL Post-Doctoral Program
John Knezovich, University Relations Program Institutes and Centers
- Panel: **Young Researchers - New Careers, New Challenges**
Jean Shuler, moderator and ASCI Program Leader
Joanna Albala, 2002 New Investigator Award
Tina Back, 2000 LLNL Defense Nuclear Sciences & Laser Directorate Award
Pat Bresenhand, Co-founder of USCF Postdoctoral

Christine Hartman-Siantar, 2000 LLNL Edward Teller Fellowship
Alfredo Morales, 1999 recipient of the Sandia Employee Recognition Award
for Technical Excellence

Panel:

Science Policy, Funding and Ethics

Kathy Cromwell, moderator and Congressional Liaison

Ron Cochran, LLNL Executive Officer

Gary Ellis, Executive Secretary, National Science and Technology Council

Martha Krebs, Director, California NanoSystems Institute (past Director,
DOE Office of Science)

Appendix 3 – Student Poster Symposium

URL: <http://step.llnl.gov/symposium>

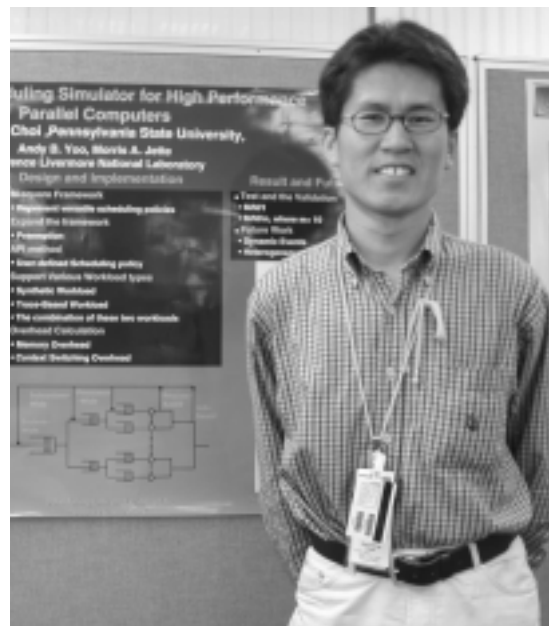
Science and Technology Education Program students are required to give oral presentations to their technical working peers at the conclusion of their research. In lieu of technical talks, they are also allowed the option to participate in a Lab-wide student-poster symposium.

Feedback from the researchers on the oral and poster presentations continues to reinforce the assessment that students gain knowledge and skills in their research area(s) which would not typically have been available at their academic level or educational institution. Management has commented on the students' enthusiasm, ability to learn new hardware and software, their inquiring minds, and fresh way of looking at challenges.

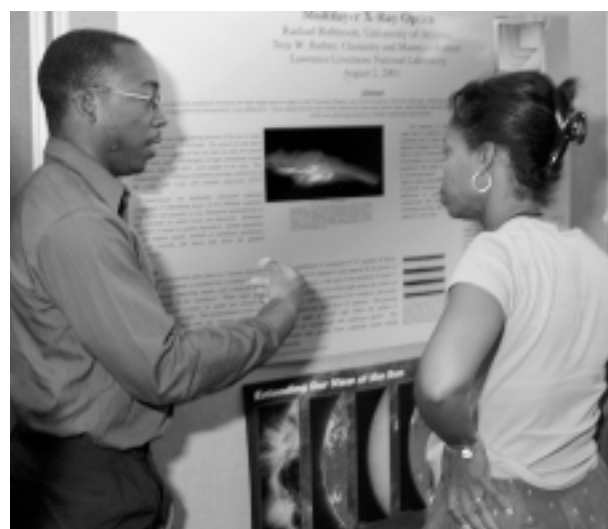
The LLNL Lab-wide symposium seeks to promote undergraduate and graduate student research by providing opportunities for students to experience, first-hand, the processes of research, exploration, and discovery that characterize working with scientific and engineering teams within a national laboratory. By providing a forum to experience the art of presenting technical research, students develop an understanding of the scientific research process, and expand their skills and knowledge within their academic fields of study.

Specifically, this symposium increases awareness of student research achievements, provides models of exemplary research, and facilitates student participation in the national scientific and engineering communities. The symposium creates a unique environment for celebrating and fostering appreciation of the valuable role students play in the research experience.

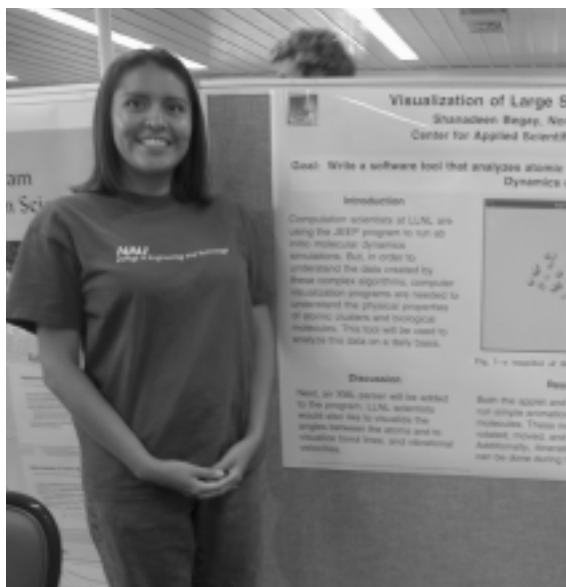
The FY01 Student Poster Symposium was sponsored by the Science and Technology Education Program. Forty students presented posters, while an estimated 125 Laboratory employees and guests came to observe the event.



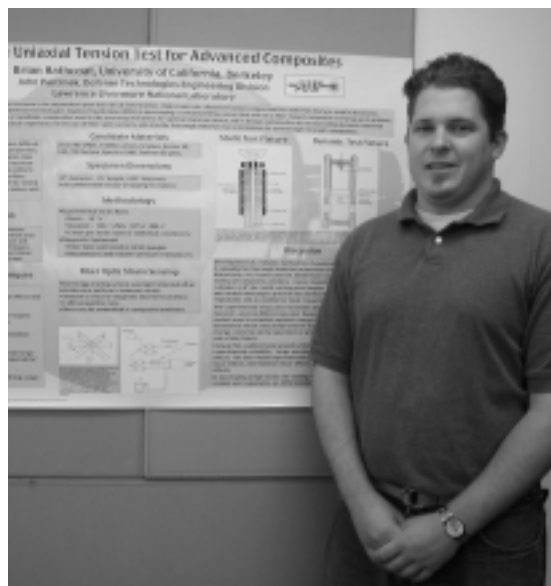
Gyu Sang Choi, Pennsylvania State University, "A Generic Scheduling Simulator for High Performance Parallel Computers"



Rashad Robinson, University of Arizona, "Multilayer X-Ray Optics"



*Shanadeen Begay, Northern Arizona University,
“Visualization of Large-Scale Molecular Dynamics”*



*Brian Hathcoat, University of California,
Berkeley, “High-Rate Uniaxial Tension Test for
Advanced Composites”*



*Adrienne Jordan, Southern Illinois University, School of
Medicine, “An Investigation of Fungi as a Microbiological
Contributor to the Corrosion of Potential Waste-Package
Materials”*

Appendix 4 – Student Portfolios

Introduction

Besides participating in oral and poster presentations, STEP student interns are given the opportunity to have their school and research accomplishments listed on the STEP student portfolio Web site:

<http://step.llnl.gov/portfolio/>

Student portfolios are categorized by the STEP projects, as in:

- Accelerated Strategic Computing Initiative Pipeline (ASCI Pipeline)
- Actinide Sciences Summer School Program (ASSSP)
- High-Energy-Density Physics Program (HED)
- Interns for Defense Technologies (IDT)
- Internships in Terascale Simulation Technology (ITST)
- Military Academic Research Associates (MARA)
- System Administration Computer Support (SACS)

or by “All 2001 Students,” which will include other summer students participating in the LLNL Scholars Employment Program (SEP).

An additional feature within the FY01 portfolio template is the participant’s expected graduation date, grade point average (GPA), and e-mail address. The e-mail address will allow students, who are considering an LLNL internship, to contact recent participants. GPA and expected date of graduation are categories suggested by the LLNL Human Resource Department staff, to facilitate recruiting possibilities.

Appendix 4 gives a few examples of the portfolios and respective posters of STEP’s FY01 student interns, which includes:

- **Shanadeen Begay** – ASCI Pipeline participant (see page 84)
- **Nicolas Cahanding** – ROTC Intern participant (see page 86)
- **Robin Chambers** – IDT participant (see page 88)
- **Brian Hatchcoat** – IDT participant (see page 90)
- **Jennifer Hughes** – ROTC Intern participant (see page 92)
- **Diana Jackson** – ITST participant (see page 94)
- **Min Shin** – ITST participant (see page 96)



Shanadeen Begay

Northern Arizona University

Major: Computer Science and Engineering/Chemistry

LLNL Program: Center for Applied Program: Scientific Computing (CASC)

E-mail: scb8@dana.ucc.nau.edu

Expected Graduation Date: 2004

GPA: 3.5

Abstract

I created a JAVA program that displayed the positions/trajectories of various atoms on a GUI screen.

My program was written to read an .XYZ file, interpret the x,y,z coordinate data, and display an animation sequence that showed the motion of these atoms and molecules in three dimensional space.


Some of the features included:

- Applet or application capabilities
- I/O parser for input file
- Double-buffered animation
- Multi-threaded reader/GUI interactive
- Ease in usage across various platforms.

This program is used in conjunction with the JEEP code created in the Scientific Computing Group of the CASC department.

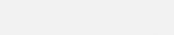
Impact on Education

I was exposed to various simulation technologies that are used at LLNL and created my own scientific application. This experience will help me in my classes next fall and my research for the Physics and Astronomy Department at Northern Arizona University. I have learned a great deal about the proper implementation of various abstract ideas/protocols into the structure of a computer program.



Visualization of Large Scale Molecular Dynamics

Shanadeen Begay, Northern Arizona University
Center for Applied Scientific Computing, Francois Gygi



Goal: Write a software tool that analyzes atomic trajectories generated by First Principle Molecular Dynamics code (JEEP)

Introduction

Computation scientists at LLNL are using the JEEP program to run ab initio molecular dynamics simulations. But, in order to understand the data created by these complex algorithms, computer visualization programs are needed to understand the physical properties of atomic clusters and biological molecules. This tool will be used to analyze this data on a daily basis.

Methods

The visualization tool is written in JAVA using:

- Graphics 2D API
- Swing GUI components
- Threads/double-buffering
- Applet form of the animator, as well as a stand alone application

Language: JAVA chosen was because it handles animation graphics quickly and efficiently while maintaining portability

Input file: XYZ format




Fig. 1—a snapshot of the animation sequence

Discussion

Next, an XML parser will be added to the program. LLNL scientists would also like to visualize the angles between the atoms and to visualize bond lines, and vibrational velocities.

Results

Both the applet and application can run simple animation of 1 to 1000 molecules. These molecules can be rotated, moved, and replayed. Additionally, ititerate manipulation can be done during the animation.

This work was supported by the Department of Energy, Office of Biological and Environmental Research, under contract number DE-AC02-92OR21400.

UCRL-98-10478

Further Information

- Francois Gygi (adviser) at LLNL: <http://www.llnl.gov/CASC/people/gygi/>
- Center for Scientific Computing: <http://www.llnl.gov/casc/>
- Institute for Terascale Simulation: <http://www.llnl.gov/CASC/its/>
- Accelerated Strategic Computing Initiative: <http://www.llnl.gov/asci/>
- Institute for Scientific Computing Research: <http://www.llnl.gov/CASC/isr/>
- ASCI Pipeline Internship: http://step.llnl.gov/asci_interns/
- Northern Arizona University: <http://www.nau.edu/web/index.shtml>

My Web page is still under construction. Search for me on www.google.com with keywords “Shanadeen Begay.”



Nicolas Cahanding

San Diego State University

Major: Chemistry/Biochemistry

LLNL Program: Biology & Biotechnology
Research Program/Medical Technology Program

E-mail: cahanding1@llnl.gov

Expected Graduation Date: May 25, 2001

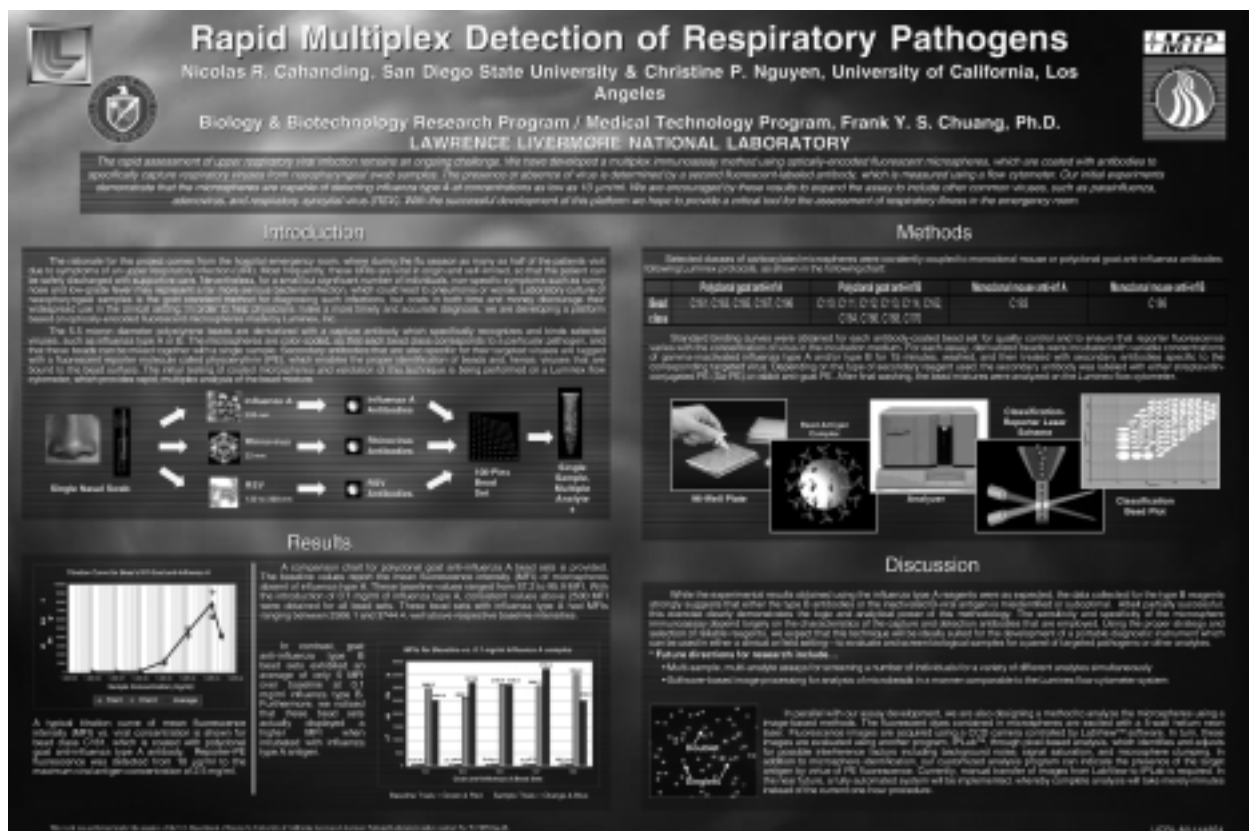
GPA: 3.5

Abstract

The rapid assessment of upper respiratory viral infection remains an ongoing challenge. We have developed a multiplex immunoassay method using optically-encoded fluorescent microspheres, which are coated with antibodies to specifically capture respiratory viruses from nasopharyngeal swab samples. The presence or absence of virus is determined by a second fluorescent-labeled antibody, which is measured using a flow cytometer. Our initial experiments demonstrate that the microspheres are capable of detecting influenza type A at concentrations as low as 10 $\mu\text{m}/\text{ml}$. We are encouraged by these results to expand the assay to include other common viruses, such as parainfluenza, adenovirus, and respiratory syncytial virus (RSV). With the successful development of this platform we hope to provide a critical tool for the assessment of respiratory illness in the emergency room. Applications of this technology may also be used in the interest of national security, such as bioterrorism and other modes of mass destruction.

Impact on Education

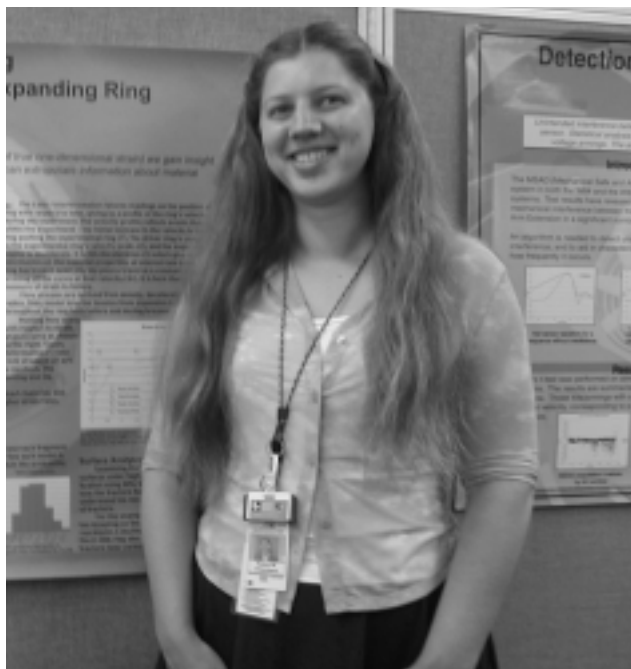
While establishing a heightened sense of appreciation for scientific knowledge, this laboratory research experience created an environment for professional development and as well as creative thought. At my first project meeting for respiratory pathogen detection, in a room filled with seasoned scientists, physicians, and engineers, I immediately realized that I was not an observer but an integral part of the research group. On the assay development team, I was given leadership responsibility to enhance cooperation, delegate tasks, and provide presentations. Together, my team and I worked to investigate novel laboratory methods for bacterial and viral detection, sharing in the spirit of exploration. Humbling and at times frustrating, experiments periodically offered inconclusive results after long, late night procedures. With these challenges, a realization of how research compliments academic studies became apparent. Scientific research



solidifies competence in basic science foundations—mathematics, physics, and chemistry—to develop protocols, analyze data, and draw conclusions. Most of all, research activities allow proactive involvement in finding answers to scientific questions, which in turn establish new questions, encouraging further advancement in basic and applied sciences. As I am currently seeking admission to a medical training program, I look forward to other opportunities in laboratory research as part of my career development.

Further Information

- Biology and Biotechnology Research Program: <http://www-bio.llnl.gov/bbrp/>
- Medical Technology Program: <http://lasers.llnl.gov/lasers/mtp/>
- ROTC Interns



Robin Chambers

Harvey Mudd College

Major: Mechanical Engineering

LLNL Program: Defense Technologies
Engineering Division

E-mail: rchambers@hmc.edu

Expected Graduation Date: 5/12/02

Abstract

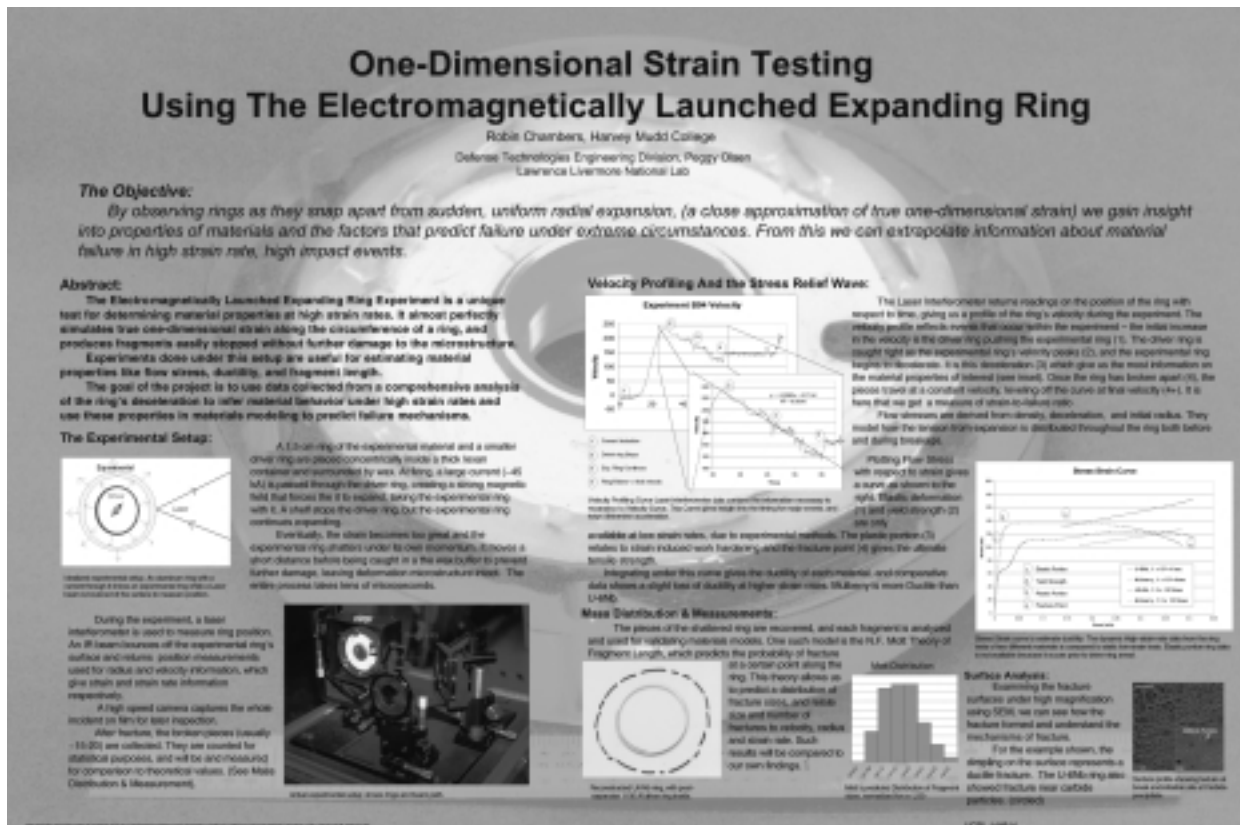
The Expanding Ring Experiment is a unique test for determining material properties at high strain rates ($\times 10^{-4}$ /sec ranges). It simulates true one-dimensional strain along the circumference of a ring using electromagnetic forces which launch the ring radially outward. The end product of the experiment is fragments captured without further damage to the microstructure.

Over the summer, I continued the ongoing ring experiments on uranium alloys, using binary and mulberry alloys. I estimated such material properties as flow stress and ductility from the velocity histories obtained during the experiments, and measured fragment lengths and weights to obtain parameters for input to fragmentation theories. By examining some of the fracture surfaces, I learned predict the mode of fracture for the mulberry alloy.

Impact on Education

Working at the Lab for a summer gave me insight into the way a truly scientific community works. I was exposed to a lot of ideas, worked with a variety of interesting and intelligent people, and got to see how the Lab's goal of "science in the national interest" is accomplished.

My own project, the Expanding Ring Experiment, inspired me to look more deeply into materials science, and gave me confidence in my ability to derive answers from often less-than-perfect data. I began to understand how real-world science both differs from and depends on the knowledge

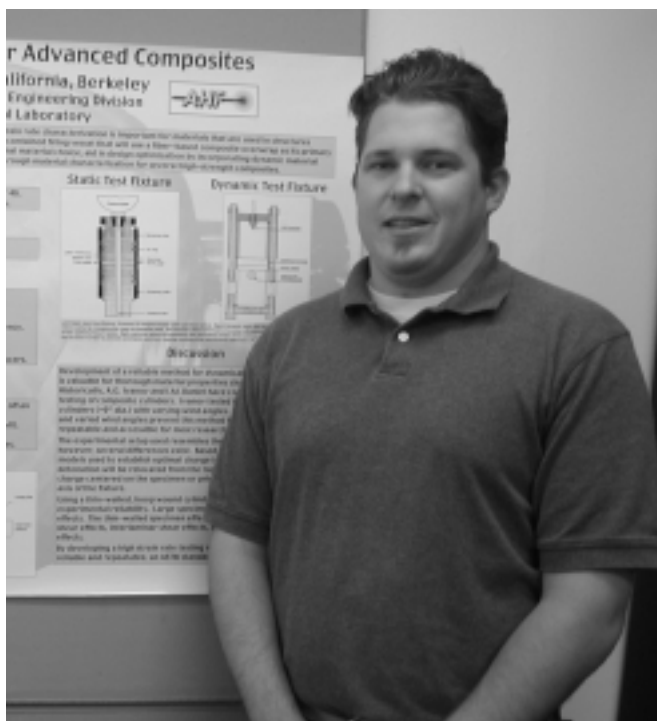


contained in my textbooks. With a few experts on the subject a phone call (or in one case, a few feet!) away, I had the opportunity to learn just how valuable the exchange of ideas can be.

Now, I'm going back for my senior year with a much better idea of the community I'll enter when I finish school, what they do, and what I might contribute to them.

Further Information

- Defense & Nuclear Technologies: <http://www.llnl.gov/dnt/>
- Defense Technologies Engineering Division:
http://www-eng.llnl.gov/eng_llnl/01_html/eng_dted.html
- Internship in Defense Technologies: <http://step.llnl.gov/idx/index.html>



Brian Hathcoat

University of California, Berkeley

Major: Mechanical Engineering

LLNL Program: Defense Technologies Engineering Division

E-mail: bhath@aol.com

Expected Graduation Date: December 2001

GPA: 3.4

Abstract


The mechanical behavior of most materials is known to be dependent upon the rate of strain. High strain rate characterization is important for materials used in structures exposed to blast or shockwave loadings. The Defense Technologies Engineering Division (DTED) is developing a high-performance composite contained firing vessel, for use in the Advanced Hydrotest Facility (AHF), that will use a composite overwrap as its primary structural member. Dynamic characterization of fiber-based composites will allow for the optimal choice in structural overwrap, aid in design optimization by incorporating dynamic material properties into computer models, provide practical experience in the use of optical based sensors, and provide a thorough characterization for several high-strength composites. A reliable test has been designed in which specimens will be subjected to uniform, high-rate, uniaxial tension in the direction of the fiber. Circumferentially (hoop) wrapped, thin-walled rings, 5" (12.7 cm) in diameter, 1" (2.54 cm) in height, and 0.050" (0.127 cm) thick will be tested explosively at rates varying from 10-3 s-1 to 5000 s-1, with multiple trials being conducted at each rate in order to establish statistical consistency. Static and dynamic Stress/strain curves to failure will be constructed from experimental data and recommendations for future testing will be made.

Impact on Education

Working at LLNL this summer has had a substantial impact on my education and the career path I will choose. The research that I have conducted over the summer has helped solidify my desire to

High Rate Uniaxial Tension Test for Advanced Composites

Brian Hathcoat, University of California, Berkeley
John Pasternak, Defense Technologies Engineering Division
Lawrence Livermore National Laboratory



The mechanical behavior of most materials is known to be dependent upon the rate of deformation. High strain rate characterization is important for materials that are used in structures exposed to blast or shock-wave loadings. The Defense Technologies Engineering Division (DTEED) is developing a contained firing vessel that will use a fiber-based composite overwrap as its primary structural member. Dynamic characterization of candidate composites used in the overwrap will allow for optimal material choice, and in design optimization by incorporating dynamic material properties into computer models, provide practical experience in the use of fiber optic sensors, and provide thorough material characterization for several high-strength composites.

Introduction

Material properties of fiber-based composites are difficult to characterize due to their highly anisotropic properties. Dynamic testing methods and property information that are currently available are inconsistent. A test has been designed in which materials will be subjected to uniform high rate uniaxial tension in the direction of the fiber. Circumferentially (hoop) wrapped thin rings will be tested explosively and dynamic stress/strain curves to failure will be derived from pressure and strain data.

Candidate Materials

Zylon HM (P40), T300G Carbon, S2 glass, Kevlar 49, G30-790 Carbon, Spectra 1080, Zantox S2 glass.

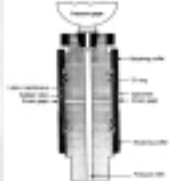
Specimen Dimensions

- 5" diameter, 1.5" height, 0.05" thickness
- circumferential (hoop) wrapping (5-8 plies)


Methodology

- Experimental Strain Rates
 - Static - 10^{-2} s^{-1}
 - Dynamic - 125 s^{-1} , 250 s^{-1} , 575 s^{-1} , 500 s^{-1}
 - 5 tests per strain rate for statistical consistency.
- Diagnostic equipment
 - Fiber Optic and resistive strain gauges.
 - Piezoelectric and resistive pressure transducers.

Static Test Fixture



Dynamic Test Fixture



Experimental Justification

Explosive testing of hoop wound cylinders eliminates irregularities associated with other testing methods and reflects dynamic loading that the AHF firing vessel will experience. Historically, explosive loading techniques have been attempted by A.G. Ivanov of the Soviet Union and L.M. Daniel of the IIT Research Institute, Chicago.

Conventional High Rate Techniques

Naval Ordnance Laboratory (NOL) Ring Test
Small specimen size (1/4" height) leads to edge effects and inconsistent results.

Electromagnetic Ring Expansion
Small specimen size, large electrical fields that require high speed optical cameras for data collection.

Split Hopkinson Bar
Grip effects, small specimen size, and fiber orientation variability lead to inconsistent results.

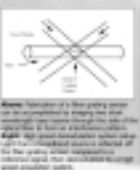
Expanding Wire
Small specimen size, large capacitor banks create large electrical fields, high speed optical cameras required for data collection.

Impact Testing
Low rates ($< 100 \text{ s}^{-1}$) do not accurately reflect firing vessel events.

Fiber Optic Strain Sensing

Fiber Bragg Grating system uses light reflected off an interference pattern to measure strain.

- Immune to electro-magnetic interference (EMI).
- 2 Mhz acquisition rate.
- Fibers can be embedded in composite laminates.



Discussion

Development of a reliable method for dynamically testing composites is valuable for thorough material properties characterization. Historically, A.G. Ivanov and L.M. Daniel have conducted explosive testing of composite cylinders. Ivanov tested large fiberglass cylinders (~9" dia.) with varying wind angles. The large mass of H.E. and varied wind angles prevent this method from being easily repeatable and accessible for most researchers.

The experimental setup used resembles the method L.M. Daniel used, however, several differences exist. Based on Hydracode computer models used to establish optimal charge location, the explosive deformation will be relocated from the top of the vessel to a spherical charge centered on the specimen or pinpoint centered along the axis of the future.

Using a thin-walled, hoop wound cylinder as a specimen produces experimental reliability. Large specimen dimensions minimize edge effects. The thin-walled specimen effectively removes transverse shear effects, interlaminar shear effects, and epoxy induced matrix effects.

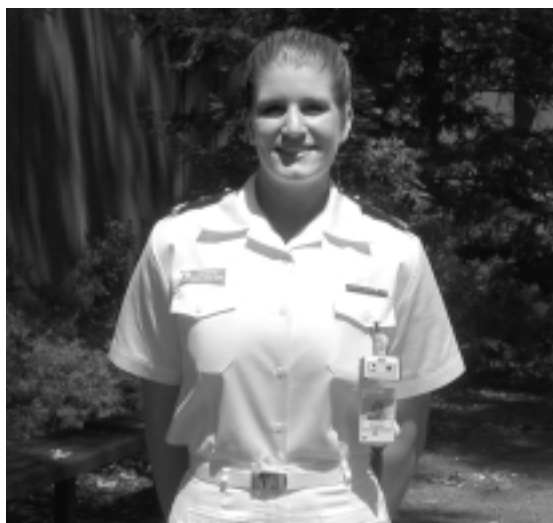
By developing a high strain rate testing method for composites that is reliable and repeatable, an ASTM standard can be developed.

pursue a career as a research scientist. I will accomplish this by pursuing a graduate education up to, at minimum, a master's degree and most likely a PhD.

I am very grateful for the opportunity to work at LLNL and have taken on an immense amount of information, both regarding my research and how business is conducted in a professional research environment.

Further Information

- Defense & Nuclear Technologies: <http://www.llnl.gov/dnt/>
- Defense Technologies Engineering Division:
http://www-eng.llnl.gov/eng_llnl/01_html/eng_dted.html
- Advanced Hydrotest Facility: <http://www.llnl.gov/llnl/ip/216ahf.html>
- Internship in Defense Technologies: <http://step.llnl.gov/idx/index.html>



Jennifer Hughes

University of Notre Dame

Major: Mechanical Engineering

LLNL Program: Laser Science & Technology

E-mail: jhughes@nd.edu

Expected Graduation Date: 2003

GPA: 3.0

Objective

The objective of this project is to reduce the cost and complexity of the high-energy laser by using a low-energy laser to achieve comparable residual compressive stress.

Background

Inducing compressive stress in a material surface makes it less susceptible to fatigue and stress-corrosion cracking (SCC). Traditional shot peening has been the most widely used process in surface treatment because of its ability to induce these stresses efficiently and inexpensively on parts of complex geometry. Shot peening uses steel shots which typically achieve a depth of compressive stress of 0.010 in. and can reach 0.020 in. However, at high intensity levels, this process leaves an undesirable rough surface finish and a high degree of cold work.

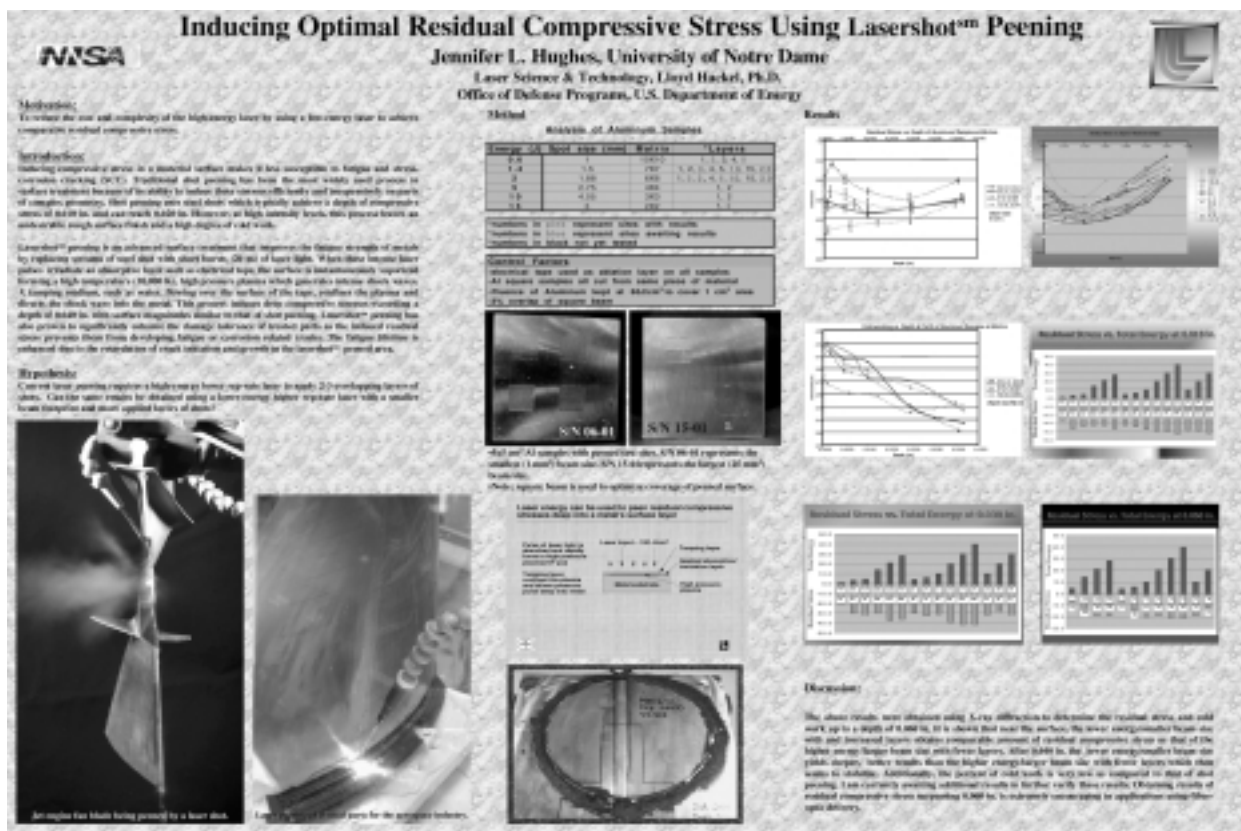
LasershotSM peening is an advanced surface treatment that improves the fatigue strength of metals by replacing streams of steel shot with short bursts (20 ns) of laser light. When these intense laser pulses irradiate an absorptive layer such as electrical tape, the surface is instantaneously vaporized forming a high temperature (10,000 K), high-pressure plasma which generates intense shock waves. A tamping medium, such as water, flowing over the surface of the tape, confines the plasma and directs the shock wave into the metal. This process induces deep compressive stresses exceeding a depth of 0.040 in. with surface magnitudes similar to that of shot peening. LasershotSM peening has also proven to significantly enhance the damage tolerance of treated parts as the induced residual stress prevents them from developing fatigue or corrosion related cracks. The fatigue lifetime is enhanced due to the retardation of crack initiation and growth in the laser-peened area.

Hypothesis

Current laser peening requires a high-energy lower rep-rate laser to apply 2-3 overlapping layers of shots. Can the same results be obtained using a lower-energy higher rep-rate laser with a smaller beam footprint and more applied layers of shots?

Impact on Education

Having had the entire summer to dedicate to research and work within the LS&T and MARA programs, I gained exposure to the research and development side of LLNL as well as the different projects/careers



that exist among engineers, scientists, and military officers. Through the MARA program, I was a part of the integration between LLNL and the military in developing new technology while having toured many facilities and attended weekly briefs that was specific to military applications and goals. I was responsible for learning how to operate a Tencor surface profilometer that had not been used for some time. I then taught my coworkers how to run it which is very beneficial for other projects as well.

I am looking to publish my ongoing research that I am continuing while at school and through future employment at LLNL.

In order to benefit the most from this program, you need to take this opportunity seriously and dedicate as much time as you can during the summer to develop your research. Most projects take the entire summer.

My relationship with co-workers and supervisors made it a fun place to work and learn. They were very willing to help and were a great source of information. I took the opportunity to network myself among the laboratory staff for possible future employment opportunities.

Further Information

- Laser & Science Technology: <http://lasers.llnl.gov/lst/>
- Science & Technology Review Publication: <http://www.llnl.gov/str/Hackel.html>
- LS&T Organization: <http://lasers.llnl.gov/lst/lstrd.html>
- LS&T Research & Development: <http://lasers.llnl.gov/lst/lstrd.html>
- LS&T Technology & Applications: <http://lasers.llnl.gov/lst/lstapps.html>
- ROTC Interns: <http://step.llnl.gov/mara/index.html>



Diana Jackson

Wofford College

Major: Computer Science/Math/Spanish

LLNL Program: CASC

E-mail: jacksond@wofford.edu

Expected Graduation Date: May 2003

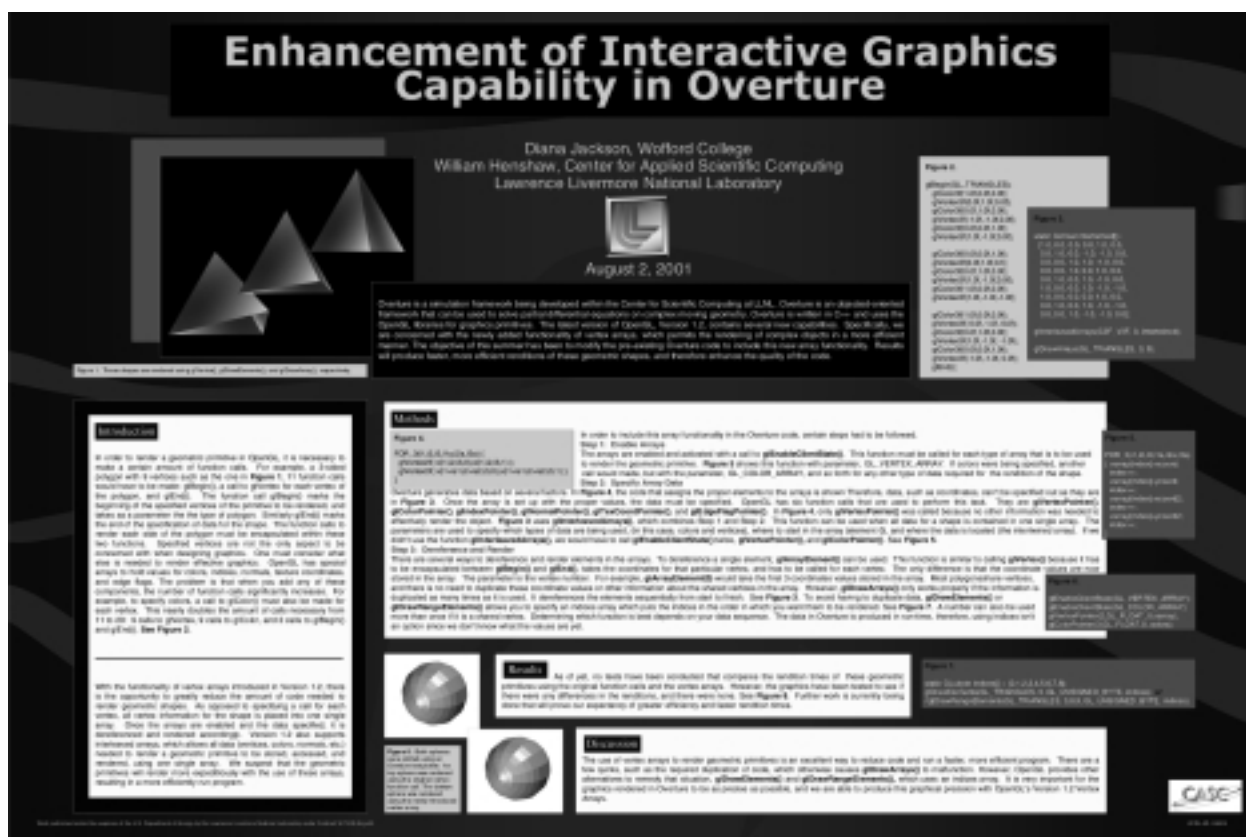
GPA: 3.2

Abstract

Overture is a simulation framework being developed within the Center for Scientific Computing at LLNL. Overture is an objected-oriented framework that can be used to solve partial differential equations on complex moving geometry. Overture is written in C++ and uses the OpenGL libraries for graphics primitives. The latest version of OpenGL, Version 1.2, contains several new capabilities. Specifically, we are concerned with the newly added functionality of vertex arrays, which permits the rendering of complex objects in a more efficient manner. The objective of this summer has been to modify the pre-existing Overture code to include this new array functionality. Results will produce faster, more efficient renditions of these geometric shapes, and, therefore, enhance the quality of the code.

Impact on Education

I feel very fortunate to have had the opportunity to participate in this program. My school is a small, private, liberal arts institution in which my opportunity to expand my knowledge in the more technical areas are limited. I have excellent resources there, which is how I ended up here. This summer has greatly enhanced my knowledge and inspired me to learn as much as I can while I am in school.



Further Information

- Center for Applied Scientific Computing: <http://www.llnl.gov/CASC/>
- Institute for Terascale Simulation: <http://www.llnl.gov/CASC/its/>
- Institute for Scientific Computing Research: <http://www.llnl.gov/CASC/isrc/>
- Accelerated Strategic Computing Initiative: <http://www.llnl.gov/asci/>
- The Overture Framework:
<http://www.llnl.gov/CASC/Overture/talks/Sept99-PPT-HTML/>
- Internships in Terascale Simulation Technology: <http://step.llnl.gov/itst/>



Min Shin

University of South Florida

Major: Computer Science

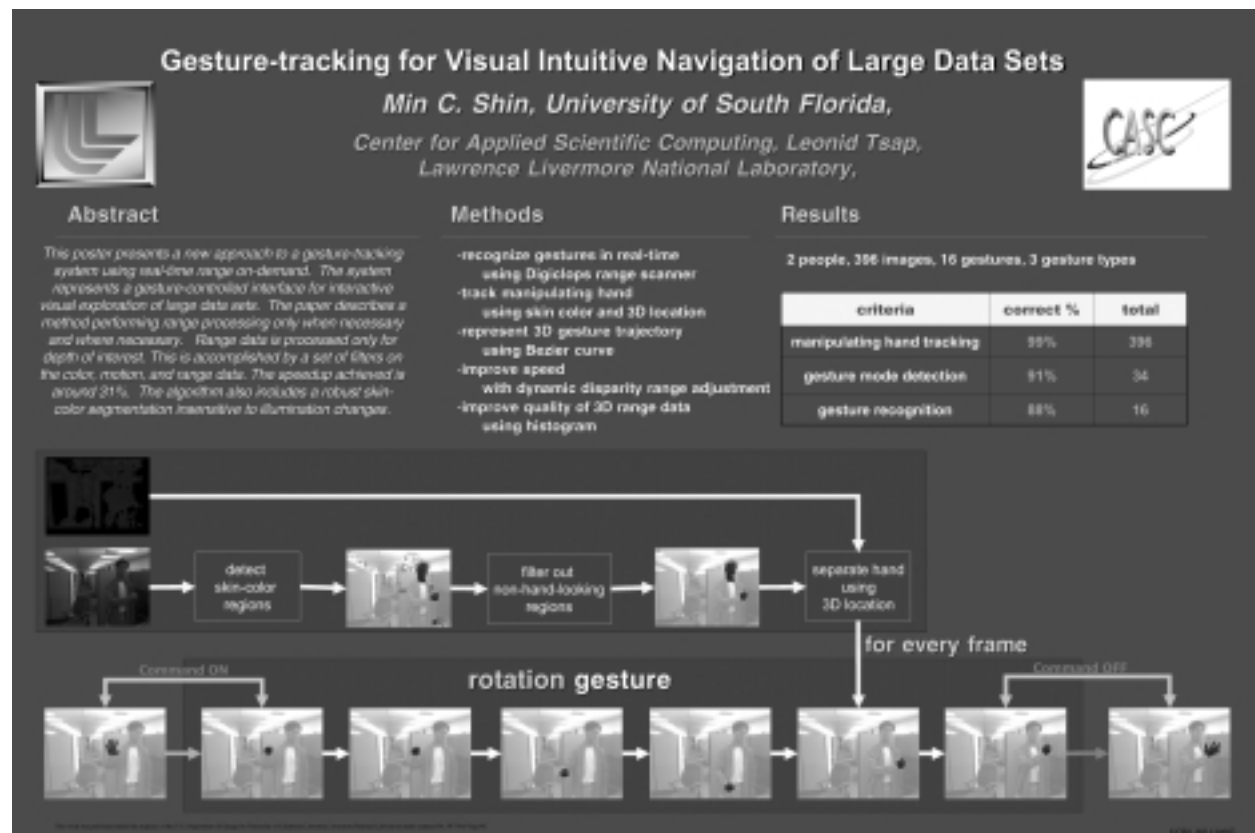
LLNL Program: CASC

Abstract

This work presents a new approach to a gesture-tracking system using real-time range on-demand. The system represents a gesture-controlled interface for interactive visual exploration of large data sets. The paper describes a method performing range processing only when necessary and where necessary. Range data is processed only for depth of interest. This is accomplished by a set of filters on the color, motion, and range data. The speedup achieved is around 31%. The algorithm also includes a robust skin-color segmentation insensitive to illumination changes.

Impact on Education

I have learned the knowledge of real-time range scanner as well as rapid method of processing images to enable real-time recognition.



Further Information

- Center for Applied Scientific Computing: <http://www.llnl.gov/CASC/>
- Institute for Terascale Simulation: <http://www.llnl.gov/CASC/its/>
- Institute for Scientific Computing Research: <http://www.llnl.gov/CASC/isrc/>
- Accelerated Strategic Computing Initiative: <http://www.llnl.gov/asci/>
- Internships in Terascale Simulation Technology: <http://step.llnl.gov/itst/>

Appendix 5 – Student Interviews

Introduction

An evaluation is completed at the end of the summer on each of these programs:

- Accelerated Strategic Computing Initiative Pipeline (ASCI)
- Actinide Sciences Summer School Program (ASSSP)
- High-Energy-Density Physics Program (HED)
- Interns for Defense Technologies (IDT)
- Internships in Terascale Simulation Technology (ITST)
- Military Academic Research Associates (MARA)
- ROTC Interns
- System Administration Computer Support (SACS)

The purpose of the assessments is to provide an evaluation of the programs, both individually and collectively. The evaluation is conducted near the end of the program, during August and September, in the case of summer internships. Assessment tools include a measurement of student learning; measurement of student satisfaction or rating of internship experience; and an evaluation of the administration of the program.

The combination of these assessments is specific to each project; however, generalizations are appropriate and applicable for the many internship programs administered by STEP.

Because of space limitations, only the 21 evaluation questions are provided in this appendix. Student answers are available by contacting STEP's college intern manager Barry Goldman, (925) 422-5177, goldman1@llnl.gov.

Survey for Participants in LLNL STEP Summer Program, FY'01

1. *How did you find out about your internship?*
2. *Why did you choose to come to LLNL, as opposed to another institution?*
3. *How well did your research interests match your research project?*
4. *How did your research project relate to your academic background and education goals?*
5. *Did you have adequate work space, resources and computer access?*
6. *How well did you get along with your mentor and other lab personnel whom you worked with?*
7. *Were the directions given by your mentor clear and specific?*
8. *Did you gain further theoretical knowledge and practical experience in your research area through your internship experience?*
9. *What computer knowledge and skills did you acquire?*
10. *What is unique about this research internship and possibly not available through your University?*
11. *Was your experience helpful in broadening your awareness of LLNL's involvement in support of our NNSA mission of stockpile stewardship?*
12. *Describe your contribution to ongoing research in your project at LLNL.*
13. *How did your research assignment (if at all) influence or redirect your career interests?*
14. *If you are going to give a presentation upon your return to your campus, about your experience at LLNL, what would you most want to talk about?*
15. *Describe any networking you accomplished . . . with other students, laboratory scientific staff, etc.?*
16. *Describe which seminars/tours you preferred and why.*
17. *Describe which seminars/tours should not be continued and why.*
18. *Describe any other summer student activities/briefings/socials you participated on during your stay . . . and/or any you would suggest should be scheduled?*
19. *If you were in charge of this program, what changes would you make?*
20. *If you accessed the STEP 'Student Opportunities' Web site at http://step.llnl.gov/step_student.html what improvements/changes will make it more helpful to new students considering LLNL for internships?*
21. *If you accessed the Student Bulletin Board Web site at <http://step.llnl.gov/sbb> what improvements/changes will make it more helpful to new students considering LLNL for internships?*

Appendix 6 – LLNL Science Education (1952-2002)

Throughout its 50-year history, LLNL has consistently provided the education community with access to its unique facilities and scientific expertise. This commitment to connecting science education to science research finds its roots in the close relationship between the Laboratory and the University of California. It also comes from the realization that the leading-edge research conducted at the Lab requires the development of skills not always readily available or acquired from academia or industry.

The Laboratory's science education activities have historically involved four major audiences:

- K-12 students
- K-12 teachers
- Undergraduate and graduate students
- College and university faculty

Current LLNL science education activities for all four audiences are summarized at <http://www.llnl.gov/education>. This LLNL education Web site provides links to the various Laboratory programs that manage the pre-college, college, and post-graduate education programs.

For a summary of the various science education programs available 10 years ago, refer to the April 1991 issue of Energy and Technology Review (UCRL-52000-91-4) that is dedicated to LLNL science education activities. This issue not only featured 12 articles on individual programs but also listed approximately 50 programs that spanned kindergarten through post-graduate school, with 29 programs focused on K-12.

For education accomplishments prior to 1991, the Education Section within the Lab's 40th anniversary publication, "Preparing for the 21st Century for 40 Years of Excellence" (UCRL-AR-108618) is dedicated to the history of the Lab's science education programs from an institutional overview. It is important to recognize, as was done within the 40th anniversary publication, the rich history of the Lab's Apprenticeship and Training Programs, Native American Program, Associated Western Universities (AWU) consortium, the UC Davis Department of Applied Science (DAS), and UC-LLNL institutes and university collaborations.

Of particular interest is the 50-year history of the Laboratory's commitment to K-12 science education. There have been several major evolutions in the management and execution of this particular aspect of science education at LLNL:

- 1950s and 1960s – Laboratory employees participate in education activities but without the benefit of an institutional perspective.
- 1969 – Livermore Elementary School Study of Nature (LESSON) is offered to Oakland schools as a vehicle for reaching underrepresented groups within the science and engineering disciplines.

- 1976 – Lab’s Visitors Center opens and has a science-outreach component.
- 1984 – Science Education Center at Almond Avenue School in Livermore is established to support LESSON and computer workshops.
- 1986 – Science Education (formerly within Human Resources Planning and Development) moves to Almond Avenue School and is co-located with the Science Education Center to provide an institutional perspective. (Manuel Perry is named the first director.)
- 1990 – Director John Nuckoll releases an Administrative Memo that establishes the Education Program. The Program reports to Deputy Director Phil Coyle and supports the addition of education to the mission of DOE under Secretary Admiral Watkins. (Refer to the following page for a copy of the Administrative Memo.)
- 1994 — Education Program returns to the main LLNL site and moves into B415. (Eileen Vergino is named director.)
- 1998 – K-12 Science Education and DOE-DP College Internships become separate programs within the newly defined Science and Technology Education Program, STEP. (Don Correll is named director.)
- 2001 – Groundbreaking of the Edward Teller Education Center at UC Davis DAS site as a partnership between LLNL STEP, UC Davis, and UC Merced, in support of statewide K-12 science education.

The future of LLNL K-12 science education activities will find its strengths in partnerships inside various elements of the Laboratory and within the University of California system, and working collaboratively with the K-12 education community. The vehicle for supporting these partnerships will continue to be the LLNL employees who contribute to the local and regional community by sharing the Laboratory’s wealth of information through personal contacts with students and teachers. New directions and ongoing accomplishments will be available from STEP annual reports and Web site, <http://step.llnl.gov>.

administrative MEMO

Personnel and Organization activities

Vol. 20, No. 91

December 18, 1990

LABORATORY SCIENCE EDUCATION PROGRAM

Secretary Watkins has challenged the DOE laboratories to become involved in improving science education. He has asked each laboratory and research facility to make a commitment to participate in science education programs. In the FY 1991 Defense Authorization Bill, the Congress authorized science education activities as an appropriate function of DOE and its laboratories and appropriated \$50M.

To meet this challenge, I am establishing a science education program reporting to Principal Laboratory Associate Director Phil Coyle. The Education Relations Division, headed by Manuel Perry, will transfer from Human Resources to the Director's Office and report to Phil. Phil and Manuel will undertake an evaluation of our current activities, assess the needs to which the Laboratory might appropriately direct resources, and propose principles and directions to guide future efforts. They will be responsible for developing the Laboratory's science education program.

John H. Nuckolls
Director

Appendix 7 – STEP Contact Information

Name	Phone Number	Fax Number	E-mail Address
Alvarez, Mitch	(925) 422-9631	(925) 422-5761	alvarez4@llnl.gov
Correll, Don (Director)	(925) 422-6784	(925) 422-5761	correll1@llnl.gov
Falls, Kerwin	(925) 422-6098	(925) 422-5761	falls3@llnl.gov
Farnsworth, Dick	(925) 422-5059	(925) 422-5761	farnsworth1@llnl.gov
Goldman, Barry	(925) 422-5177	(925) 422-5761	goldman1@llnl.gov
Lundin, Davien	(925) 422-5460	(925) 422-5761	lundin2@llnl.gov

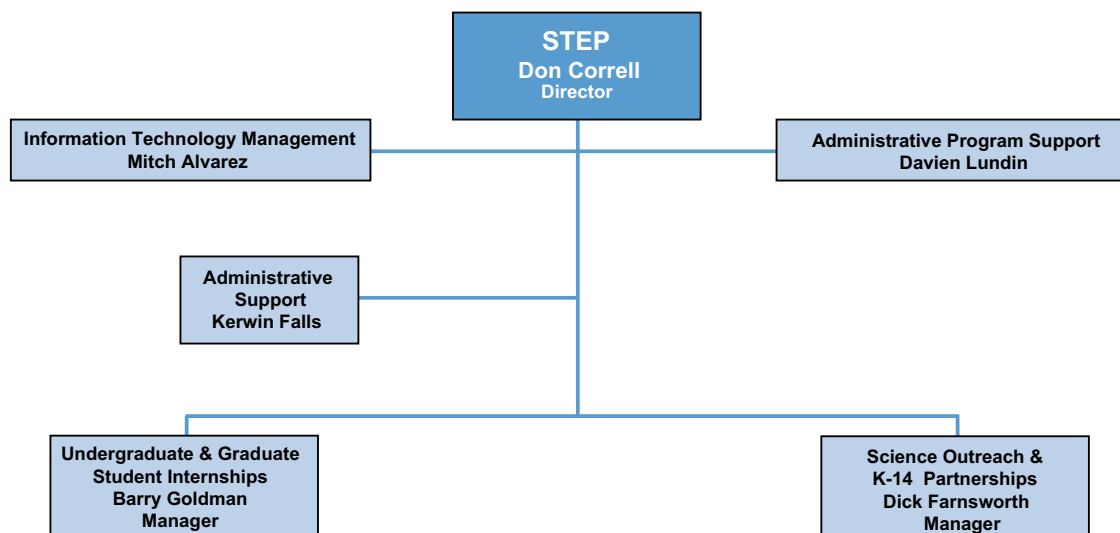
Science & Technology Education Program (STEP)

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